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**Characterization of student strengths, leadership domains and student perceptions on success**

by

**Saxon J. Ryan**

A dissertation submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Industrial and Agricultural Technology

Program of Study Committee:  
Gretchen A. Mosher, Major Professor  
Steven A. Freeman  
Amy L. Kaleita  
Brian L. Steward  
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Scott W. Smalley

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2020

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## **DEDICATION**

This dissertation is dedicated to

my wife, Sarah E. Ryan, whose support and encouragement  
made the completion of this work possible

and

my parents, Sidney and Tangela Ryan for enabling my success  
through the lessons and experiences they shared with me

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## ABSTRACT

This research explored the strengths of students in the Agricultural and Biosystems Engineering (ABE) Department at Iowa State University identified by the Clifton StrengthsFinder and the relationship between those strengths and student success. In the department, students are taught about strengths early in their program to help them better understand how to utilize their unique aptitudes to be successful, but limited analysis has been done on these data. The purpose of this research was to analyze the student strengths data to characterize patterns of strengths among the students, identify patterns of leadership domains, and explore connections of how students use their strengths. Three years of student strengths data were collected and analyzed to identify differences between gender and type of major (technology or engineering) in the department.

The first objective of this research was focused on the characterization of student strengths in the department. The goal for this part of the research was to identify patterns of strengths among students to build a foundation of what student strengths are in the department. Project data identified the frequency of occurrence for each of the individual strengths in the students' top five. Data were analyzed to determine if there were differences in strengths between gender and type of major, engineering or technology. Though previous research indicated there should be no pattern of strengths, this research identified multiple patterns of common strengths among gender and type of major. Six strengths can be used to describe the departmental students: Achiever, Adaptability, Analytical, Relator, Responsibility, and Restorative. The Restorative strength, which describes people who enjoy solving problems, carries through all groups in the department.

The second objective of this research was focused on the characterization of student leadership domains. The leadership domains are groups of strengths that describe how people work together. The goal of this research was to analyze the student strengths data to identify potential patterns of leadership domains among the students. Data were collected and analyzed to identify differences in leadership domains between gender and type of major (technology or engineering) in the department. Multiple patterns of leadership domains among the different groups in the department were identified. The Executing leadership domain occurred most frequently across all groups in the department except for technology major females. The most prevalent domain for females in Technology was Relationship-Building.

The final objective of this research was to identify how students used their strengths and if they perceived a connection between their strengths and their success. The goal of this component of the research was to interview and survey students to determine how students have used their strengths, the connection between their level of understanding and their success, and the relationship between a student's understanding of their strengths and student GPA. To provide an overview of the departmental perceptions, a survey was sent to students to determine their perceptions on the relationship between their strengths and their success. Further, a semi-structured interview was conducted with selected students to ask more in-depth questions about how students used their strengths. The survey and the interview resulted provided complementary information on participant explanations of using their strengths in academic tasks. Frequently, participants described the use of their strengths when working with others. The results from the survey showed no significant difference in the average ranking of student use of strengths in their career, in their personal life, and in their academic tasks. Finally, no there was no statistically significant connection between student understanding of and use of strengths.



## **CHAPTER 1. OVERVIEW OF RESEARCH**

### **Introduction**

Clifton StrengthsFinder strengths have been shown to play a role in workplace success around the world in industry and academia (Asplund et al., 2014; Cantwell, 2006; Tomkovick & Swanson, 2014). The Clifton StrengthsFinder (CSF) is a tool used to measure an individual's aptitudes, providing an understanding of where to focus efforts to build their strengths. The strengths from the CSF are patterns of reoccurring thoughts, feelings, and behavior (Asplund, et al. 2014). In other words, strengths are the mastery of someone's abilities that are further improved through practice and application (Rath & Conchie, 2008). When individuals understand their strengths, they better understand how they can excel and improve in areas where they have the strongest gifts rather than just meeting expectations (Louis, 2012). Rath and Conchie (2008) argue that if you spend your life trying to be good at everything, you will never be good at anything. Instead, they advocate using the CSF to identify how you think, feel, and behave in various situations so that you can invest in these areas to pursue excellence. One can spend time trying to enhance what they aren't good at but Rath and Conchie (2008) argue this could lead to a person having a long list of mediocre abilities rather than a small list of areas of expertise.

The CSF goes further than providing individuals with their strengths, it also categorizes strengths into leadership domains. The leadership domains provide individuals with information on how to broadly apply their strengths as well as how they can be used in leadership roles. Overall, the leadership domains provide a better understanding of how individuals can contribute to a team (Rath and Conchie 2008). Teams with diverse leadership domains form stronger teams due to the diverse abilities, talents, and approaches (Allen et al. 2013; Rath and Conchie, 2008;

Shimazoe and Aldrich 2010). The way individuals use strengths in each domain will vary but they will find a way to accomplish the task within that domain.

The CSF is an online survey tool where participants are asked to rank how well 177 situations describe them related to their thinking, feeling, and behavior. These common situations are related to one of 34 themes, where each theme is a strength. Depending on how the participant answers the questions, the themes will be ranked from most to least frequently occurring. The top 5 themes, or strengths, are provided to the participant as the result (Asplund et al., 2014). Each of the top 5 strengths that are provided to the participants, are categorized into one of four leadership domains: Executing, Influencing, Relationship Building, and Strategic Thinking (Asplund et al., 2014). Table 1 provides an overview of all 34 strengths and their corresponding leadership domains. Appendix D provides a brief definition of each strength and Appendix E provides a brief description of each leadership domain.

Table 1. Strengths Within Each Leadership Domain.

<b>Executing</b>	<b>Influencing</b>	<b>Relationship Building</b>	<b>Strategic Thinking</b>
Achiever	Activator	Adaptability	Analytical
Arranger	Command	Developer	Context
Belief	Communication	Connectedness	Futuristic
Consistency	Competition	Empathy	Ideation
Deliberative	Maximizer	Harmony	Input
Discipline	Self-Assurance	Includer	Intellection
Focus	Significance	Individualization	Learner
Responsibility	Woo	Positivity	Strategic
Restorative		Relator	

Schreiner (2006) notes that before using a tool such as the CSF, one should understand the reliability, ability to provide consistent results, validity, how well it measures CSF strengths, and appropriate use of the CSF. Schreiner (2006) compared results of the CSF with valid and

reliable psychological tests, including the California Psychological Inventory (CPI) and the 16 Personality Factor (16PF) test. The CPI and 16PF were chosen as baseline comparisons because of their relatedness to the strengths provided in the CSF. The CSF was found to be reliable in that students received consistent results in terms of individual strengths and repeatable top 5 strengths. The validity of the CSF was demonstrated through a comparison of individual strength results to the individual results of the CPI and 16PF, where 93.4% of CSF results were successfully predicted based on the results of the CPI and 16PF. Finally, Schreiner (2006) describes the use of the CSF as a tool for personal development and growth, providing a foundation for student development through college and beyond.

Kahu and Nelson (2018) have described how student success is linked to student engagement with their studies. Kahu and Nelson (2018) describe engagement as students who not only understand what they are learning, but also ask further questions, apply knowledge appropriately, and actively seek out more information. When students feel comfortable with the course content and know how they can participate or contribute to a team, the team and the students are more successful. Rath and Conchie (2008) describe how leadership domains help individuals broadly understand how they can contribute to a team. Understanding of student leadership domains may assist in the formulation of successful and engaged teams.

Research exploring a multitude of factors influencing student success has been conducted across the country in several fields of study. Kahu and Nelson (2018) argue that while student retention and success has been widely studied and repeatedly, one factor that often emerges to predict retention and success is student engagement. Furlong, Gilman, Huebner, and (2014) and Seligman and Csikszentmihalyi (2000) focus on positive psychology. They describe how strengths-based initiatives assist people in identifying their strongest abilities, leading them to

engage in activities that further develop their gifts and aptitudes. Although Rath and Conchie (2008) do have the only strengths-based program, in this research, the word “strengths” refers to the CSF.

Some research has been conducted on student success, specifically the relationship between student strengths and GPA. Lorimer and Davis (2015) investigated the strengths of engineering students within the context of abilities and expertise of engineers. From the listed identified abilities, expertise, and attributes of engineers listed by the National Academy of Engineering (NAE, 2005), Lorimer and Davis (2015) paired those attributes with CSF strengths. For example, Lorimer and Davis (2015) paired engineering-oriented strengths of Analytical and Restorative with the attribute of “analytical skills”. Lorimer and Davis (2015) found that engineering students with more “engineering strengths” were more likely to earn a higher first year GPA, suggesting there is a connection between strengths and success.

There is limited research on the topic of how students use and apply their strengths in academic settings to be successful. Even fewer studies examine specific disciplinary fields. Lopez and Louis (2009) have described a strengths-based approach to education that revolves around student abilities rather than their “deficits”. The strengths-based education model identified five principles: strengths assessment, learning experience individualization, peer review of strengths-based learning, deliberate application of strengths in the classroom, and focus on strengths development. Cantwell (2006) describes how to build a classroom approach that accounts for each individual student’s strengths. The results of Cantwell (2006) showed increased attendance, greater student focus, increased questions, and assignments being turned in on time, all indicating increased student engagement with the strengths-based class. Further, Schreiner (2006) describes how the utilization of strengths in the classroom can help students

thrive in their academic environment rather than merely surviving. However, there is no description or empirical measurement on student perceptions of their individual strengths as used in the classroom to improve their academic performance.

Previous research has been completed within this department and institution measuring predictive success and failure factors for students in engineering (Kaleita et al., 2016; Geisinger and Raman, 2013) and technology (Mosher, 2018). Kaleita et al. (2016) and Mosher (2018) examined student success and both analyses found high school GPA to be an influential predictor. However, different results were identified when examining the differences between the engineering and technology students. Kaleita et al. (2016) found that math placement test scores and Math ACT scores were significant predictors of GPA for engineering students while Mosher (2018) did not find these as significant predictors of GPA for technology students. Kaleita et al. (2016) provided guidance on how to examine student achievement and the costs of intervention but did not explain why some students who were classified as “low-risk” left the field of engineering. Nor did the model address how and why some students who are classified as “high-risk” persist and succeed, despite academic, social, and other constraints, suggesting another explanatory variable or variables might explain student success. One hypothesis is that student strengths explain and predict some of the success of students in both engineering and technology.

The StrengthsFinder model posits that people are drawn to things they naturally excel at (Rath & Conchie, 2008). Students may be drawn to one major or the because of a set of natural strengths and abilities that align with those emphasized by the department or discipline. However, previous research has suggested there should be no pattern in strengths or best set of strengths by discipline. Rather, strengths are individualized and utilized by people differently when completing a task (Lopez & Louis, 2009; Kahu and Nelson, 2018; Rath & Conchie, 2008).

However, Lorimer and Davis (2015) were able to identify connections between success and strengths in the engineering field of study. Further, Janke et al. (2015) found patterns of strengths among pharmaceutical students and gender at different universities across the Midwest. These findings suggest that though there may be no one set of strengths that make a person more or less successful, there may be a set of strengths that can characterize a field of study.

Before investigation can begin on how students are using their strengths in courses and if there is any connection to academic tasks or fields of study, a baseline foundation of data on student strengths must be built. The foundation of understanding on student strengths facilitates the identification of patterns between student success and strengths.

### **Purpose**

The students in all majors within Agricultural and Biosystems Engineering department have been completing the Clifton StrengthsFinder since the spring of 2016 because it was hypothesized that understanding one's CSF strengths would help them better understand how to utilize their unique aptitudes to be more successful (Louis, 2012). To better understand patterns of student strengths, leadership domains, and how these concepts are used by students, three research studies were completed. The overall purpose of the research was to characterize the use of strengths and leadership domains in the department from student data and student perceptions. The following objectives and research questions laid the foundation for exploring student strengths in the department.

**Objective 1**

Identify and characterize the patterns of student strengths in engineering and technology students the department. The specific research questions this research aimed to answer were:

- What are the strengths that characterize the students in the department?
- Do students of different genders have different strengths profiles?
- Do students in different majors have different strengths profiles?

**Objective 2**

Identify and characterize the leadership domains of departmental students. The focus was to answer the following research questions:

- What are the leadership domains of the students in the department?
- What are the differences in leadership domain profiles between males and females in the department?
- What are the leadership domain profiles of technology and engineering students in the department?

**Objective 3**

Identify how students were using their strengths and if they perceive a connection between their strengths and their success. The questions this research aims to answer are:

- How have students used their strengths during their academic experiences?
- What influence does student understanding and use of strengths have on student academic success?
- Is there a relationship with use and understanding of strengths and GPA?

## Methods

This research was reviewed by the institutional review board, IRB ID18-496, and was declared exempt from further review. The data in this research were a combination of student data, survey data, and interview data. Student strengths data containing student names and strengths were obtained through an introductory course. Data from the Spring of 2016 through the Fall of 2018 were merged with Registrar data to include other variables such as gender and major. All departmental students who took the Clifton StrengthsFinder CSF in the time frame were included in the data set. Students with majors outside of the department were removed from the data set. The students outside of the department likely took the ABE or TSM 201 course and then switched majors later in the academic career thus including them in the original data. The final data set totaled 826 students, after removing 21 non-departmental majors and 1 student without academic data. The data groups are summarized in Table 2.

Table 2. Data Groups

Group Number	Group Description	Number of Students
1	All departmental students	826
2	All Male departmental Students	732
3	All Female departmental Students	94
4	All Technology Students	619
5	Male Technology Students	578
6	Female Technology Students	41
7	All Engineering Students	207
8	Male Engineering Students	154
9	Female Engineering Students	53

To answer the research questions from objective 1, a frequency analysis was conducted on the groups listed in Table 2 to characterize them individually and as a whole. The characterization consisted of frequency counts of student strengths to identify the most and least frequently occurring strengths in each of the groups. The frequency count reflected the combined



top 5 strengths of students, without regard to the order the strengths appeared. This characterization described how frequently a given strength occurred in the top five strengths of the students in each group. Frequency of occurrence for strengths in each group were then compared to identify patterns and differences between and among groups. These counts and patterns were then used to characterize the strengths of students in the department.

For objective 2, a frequency analysis was conducted on each of the groups listed in Table 2 to characterize the strengths and leadership domains for each student. First, the number of strengths in each leadership domain for each student was quantified. Then, for each student, the top five strengths were categorized into domains as shown in Table 1 and the number of the strengths per domain were quantified. This characterization described how many strengths each student had in one of the four leadership domains. This characterization facilitated further analysis of the dominant leadership domains. A dominant leadership domain was where students had three or more strengths in a single leadership domain. Each of the groups had a “dominant count” and percentage that was the number of students with three or more of the five strengths in a single domain. For example, if a student had Analytical, Deliberative, Learner, Futuristic and Relator as their top five strengths this would translate to three strengths in the Strategic Thinking domain, Analytical, Learner, and Futuristic, one strength in the Executing domain, Deliberative, and one strength in the Relationship Building domain, Relator. Further, because there are three strengths in one domain, this student would be counted as a student with a dominant domain of Strategic Thinking.

Objective 3 was accomplished through the use of multiple methods. A mixed methods approach was used to gather information on quantitative and qualitative perception variables. To quantify departmental student perceptions on their strengths, an electronic survey instrument was

sent to all students by email. The survey had a classification question to determine if the students had already taken to the CSF. If the student had not taken the CSF, the survey would take the participant to the end of the survey and not collect any data. Participants who had taken the CSF were asked demographic questions about their major, GPA, gender, how well they knew their strengths, and how they used their strengths. In the survey, participants were asked to briefly describe experiences where they applied their strengths. This survey provided the opportunity to gather a dataset of quantitative student data for later comparison with qualitative student data across all majors in the department.

A semi-structured interview was conducted with students to ask more in-depth questions about how students use their strengths. Kallino, Pietilä, Johnson, and Kangasniemi (2016), described the semi-structured interview as a common qualitative data collection method that allowed for versatility in the interview process by allowing the research to ask follow up questions based on participant responses. The semi-structured interview process provided a flexible method of inquiry of student perceptions of strengths and success. Participants were selected in a quota sampling method (Gideon, 2012). The sample intentionally included participants from each of major types and from different genders to provide information that was representative of the department student population. The interview asked similar questions to the survey but provided the opportunity to pose follow-up questions to participant responses. Each of the interviews were recorded and transcribed to analyze the responses from each of the participants. The responses to each question were summarized into themes for each of the participants. Initially, four pilot interviews were conducted with the purpose of determining if the interview was providing the needed information and to familiarize the interviewer with the interviewing process.

## Structure

This dissertation follows the manuscript format defined by Iowa State University's Graduate College. The first chapter provided background on the research and introduced the objectives and methods for the research in this dissertation. Chapters two, three, and four are manuscripts formatted for submission to research journals. Chapter five summarizes the findings from all three studies and provides interpretation on the dissertation as a whole.

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## **CHAPTER 2. ANALYSIS OF ENGINEERING AND TECHNOLOGY STUDENT STRENGTH PATTERNS USING STRENGTHSFINDER**

Manuscript submitted to: *The Journal of Technology, Management, and Applied Engineering*

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### **Abstract**

Strengths as measured by the Gallup's Clifton StrengthsFinder (CSF) test have been shown to play a role in workplace success around the world in industry and academia. This research investigated the role CSF strengths play in the classroom success of engineering and technology students in an engineering department within a large, Midwestern, research-intensive, land-grant university. In the department, students are taught about strengths as part of a required sophomore-level course to help them better understand how to utilize their unique talents to be successful, but limited analysis has occurred on these data. The purpose of this research was to analyze the student strengths data to identify potential patterns of strengths among the students. The previous three years of student strengths data were collected and analyzed to identify differences between gender and type of major (technology or engineering) in the department. Previous research suggests that there should be no patterns of strengths or best set of strengths for specific majors or on the basis of gender. This research has identified that there are multiple common strengths among students when comparing gender and type of major. Results of this research provide a characterization of student strengths to assist in curriculum development, advising, and engagement and retention applications.

### **Introduction**

An understanding of an individual's strengths as defined by the Clifton StrengthsFinder (CSF) have been shown to play a role in workplace success around the world in industry and

academia (Asplund et al., 2014; Cantwell, 2006; Tomkovick & Swanson, 2014). This research aimed to characterize the strengths of undergraduate engineering and technology students in a large four-year, public, research-intensive land-grant university. The academic department in this study offers two engineering majors and two technology majors. Students in the department complete the strengths profile early in their program because it is hypothesized to help them better understand how to utilize their talents to be successful (Louis, 2012). However, this hypothesis has not been empirically tested in the department. Before any correlations could be measured between student success and student strengths, a characterization of the student strengths was needed.

Previous studies have been completed within this department and institution measuring predictive success and failure factors for students in engineering (Kaleita et al., 2016; Geisinger and Raman, 2013) and technology (Mosher, 2018). Kaleita et al (2016) examined the identification of at-risk students and their likelihood to persist in engineering. Mosher (2018) investigated factors influencing the success of technology students who transferred into their technology program from an engineering program. Both analyses found high school GPA to be an influential predictor, but from there, findings differed. Kaleita et al. (2016) found the ALEKS math placement test significant, particularly with students within specific GPA parameters. Math ACT scores were also found to be a significant predictor. While the model created by Kaleita et al. (2016) provided guidance on how to examine student achievement and the costs of intervention, it did not explain why some students who were classified as “low-risk” left the field of engineering. Nor did the model address how and why some students who are classified as “high-risk” persist and succeed, despite academic, social, and other constraints, suggesting another explanatory variable may be present.

Results from Mosher (2018) investigated the influence of academic predictors such as high school rank and GPA and ACT composite and math scores on student GPA at graduation. High school rank was found to be a significant predictor, but standardized tests and placement tests were not significant predictors in the regression model. Accordingly, Mosher (2018) found that common factors used to predict GPA in engineering students did not have the same prediction patterns with technology students, suggesting there may be other explanatory variables present. One hypothesis is that student strengths explain and predict some of the success of students in both engineering and technology. The StrengthsFinder model posits that people are drawn to things they are naturally good at (Rath & Conchie, 2008). Students may be drawn to one major or the other because of a set of natural strengths and abilities that fit within the department. It is thought that strengths can explain some of the differences in predictive factors between the technology and engineering students as well.

### **The Clifton StrengthsFinder**

Kahu and Nelson (2018), argue that the variable of student engagement has been influential in student retention and success, yet there is substantial variation in the definition, measurement, and statistical methodologies related to student engagement (Fredricks, Filsecker, & Lawson, 2016). One under-explored construct of student engagement is student strengths as measured by the StrengthsFinder. Further, Furlong, Gilman, Huebner, and (2014) and Seligman and Csikszentmihalyi (2000) focus on positive psychology and describe how strengths-based initiatives assist students in the identification of their natural talents to engage in activities that develop their talents and abilities. There is limited research exploring the connection of successful students and their strengths. By characterizing Gallup strengths of current majors, potential patterns of successful students can be identified. This pattern characterization would

allow instructors to develop an understanding of student strengths patterns and provide the potential to develop a curriculum that focuses on the students using their strengths.

The Clifton StrengthsFinder (CSF) is a tool that individuals can use to measure what they are naturally good at to identify where to focus their efforts to build on existing strengths to optimize their performance (Asplund, et al. 2014). In other words, strengths are the mastery of someone's natural talents through practice and application (Rath & Conchie, 2008). When individuals understand their strengths, they better understand how they can excel and add value with what they are doing rather than simply meeting expectations (Louis, 2012). The CSF has been used in various ways to better understand the dynamics of the workplace, students, families and individual development of strengths (Asplund et al., 2014).

The online CSF survey tool provides a series of statements related to common situations and asks participants to rank how well the statement describes them. These common situations are then related to one of 34 themes, where each theme is a strength. The themes are ranked from most to least prevalent. The top 5 themes, or strengths, are provided to the participant at the completion of the survey (Asplund et al., 2014).

### **Strengths in Education**

In a university educational context, CSF can be used in multiple ways to help students succeed and develop throughout their education and beyond. Lopez and Louis (2009) describe the strengths-based education approach as a teaching method that focuses on the positive “strengths” of students, rather than the negative “deficits” of students. Cantwell (2006) describes the strengths-based education approach as first identifying their strengths and reinforcing the use of their strengths and talents in the learning environment, which may lead to improved learning outcomes.



Strengths can be used to identify how students tackle a problem. Although Lopez and Louis (2009) claim student strengths should not have a pattern and are highly individualized, little investigation has confirmed this statement. If there is a pattern of strengths among students, it can be used to determine how to better work with the students or guide the students to work together and approach tasks. In large classes it may not be feasible to learn and understand individual student strengths thus identifying patterns in these classes could provide an understanding of the students in the class. Strengths patterns are hypothesized to emerge from many factors, including gender. Janke et al. (2015) examined gender differences with the Clifton StrengthsFinder and found that there were significant differences of strengths in pharmaceutical students of different genders.

Understanding student strengths may help educators reach beyond the goal of student success. Schreiner (2010) describes how the use of student strengths can be used to go beyond students surviving and graduating to students thriving in their programs. In other words, rather than students going to class and just making it by, students can become engaged and develop a deep understanding of the content in their courses. The overarching purpose of this paper is to build a foundation for measuring how student strengths influence university engineering and technology students by first characterizing students by strengths. Just as Cantwell (2006) describes the first step of strengths-based education as identifying student strengths, this characterization on a departmental level is a foundation to identify potential patterns currently and longitudinally.

### **Strengths in Technology and Engineering**

Previous research has suggested there should be no pattern in strengths or best set of strengths by discipline, rather, strengths are individualized and utilized by people differently when

completing a task (Lopez & Louis, 2009; Kahu and Nelson, 2018; Rath & Conchie, 2008). It is common knowledge that student interests, expertise, and talents drive them into different disciplines of study. Clifton and Nelson (1992), specifically point out that people are drawn to activities that allow the use of an individual's strengths. This difference in abilities and expertise has been described for engineers as attributes of the engineer of 2020 by the National Academy of Engineering (NAE, 2005). Further, Lorimer and Davis (2015) compiled the engineer of 2020 attributes and compared them to the strengths of engineering students to determine "engineering strengths". For example, one of the engineering attributes from NAE (2005) was "analytical skills" which was translated to "engineering strengths" with the Clifton StrengthsFinder strengths Analytical and Restorative. Another case was the NAE (2005) engineering attribute "groupwork" translated to "engineering strengths" Adaptability, Incluser, and Achiever from the Clifton StrengthsFinder strengths. Lorimer and Davis (2015), showed that students with more of their defined "engineering strengths" resulted in higher first year student GPAs. Lorimer and Davis (2015) along with Janke et al. (2015) suggest there is a link between strengths and fields of study, a finding somewhat contradictory to that of Lopez and Louis (2009).

To the authors' knowledge, there has been no research comparing strengths to technology student attributes in the same way that has been done by Lorimer and Davis (2015). There have been studies that investigate technology competencies (Doggett & Scott 2013; Jahan & Doggett, 2015) however, none of them have explored the connection to Clifton StrengthsFinder strengths. Further, The Association of Technology, Management, and Applied Engineering (ATMAE), has similar descriptions of technology curriculum programs like that of engineering attributes described in NAE (2015). In the description of the technology programs from ATMAE (2013)

similarities and differences between engineering and technology are apparent, suggesting that student strengths may also differ between the two types of majors.

### **Research goals**

The goal of this research is to identify and characterize the patterns of student strengths in engineering and technology students in an engineering department within a large, Midwestern, research-intensive, land-grant university. This research is the first step in using strengths to enhance student education in the department. The specific research questions this research aims to answer are:

- What are the strengths that characterize the students in the department?
- Do students of different genders have different strengths profiles?
- Do students in different majors have different strengths profiles?

### **Methodology**

Data were gathered from a required departmental course each semester from Spring of 2016 to Fall of 2018 where students complete the Clifton StrengthsFinder (CSF) with IRB approval. All personal identifying information was removed from data before analysis. All students who took the CSF in the time frame were included in the data set, with the following exceptions. Any student who had a major outside of the department was removed. Additionally, a student with no academic data was removed from the data set. There were 848 students on the original list, with 21 students were removed as non-departmental majors and 1 student was removed for not having any academic data. In total, the cleaned data set included 826 students.

The data set was then split into groups by gender and type of major. These data are summarized in Table 1. The First grouping was departmental students grouped by gender,

including 732 males and 94 females. The next split occurred based on the two types of majors in the department: engineering and technology majors. The engineering group resulted in 207 students while the technology group had 619. The data sets were split by technology and engineering majors, then split one final time by gender. The engineering group had 154 males and 53 females, while the technology group had 578 males and 41 females.

Table 1. *Characterization groups*

Group Number	Group Description	Number of Students
1	All Departmental Students	826
2	All Male Departmental Students	732
3	All Female Departmental Students	94
4	All Technology Students	619
5	Male Technology Students	578
6	Female Technology Students	41
7	All Engineering Students	207
8	Male Engineering Students	154
9	Female Engineering Students	53

The characterization in this study consists of frequency counts of student strengths to identify the most and least frequently occurring strengths in each of the groups. The frequency count reflects the combined student top 5 strengths, without regard to the order the strengths appeared. This characterization describes how frequently a given strength occurs in the top five strengths of the students in each group.

## Results

The first characterization was of the entire department. The most prevalent strengths of the students were Achiever, Restorative, Adaptability, Analytical, and Relator. The five least frequent were Woo, Activator, Intellection, Developer, and Connectedness. Of the five most frequent strengths in the department overall, there is a clear distinction in the top five most

frequent. Achiever, Restorative, and Adaptability occur more frequently within the department than any of the other strengths. There is also a clear gap between the frequency of the top three strengths and those that follow. A frequency count of all departmental student strengths is shown in Figure 1.

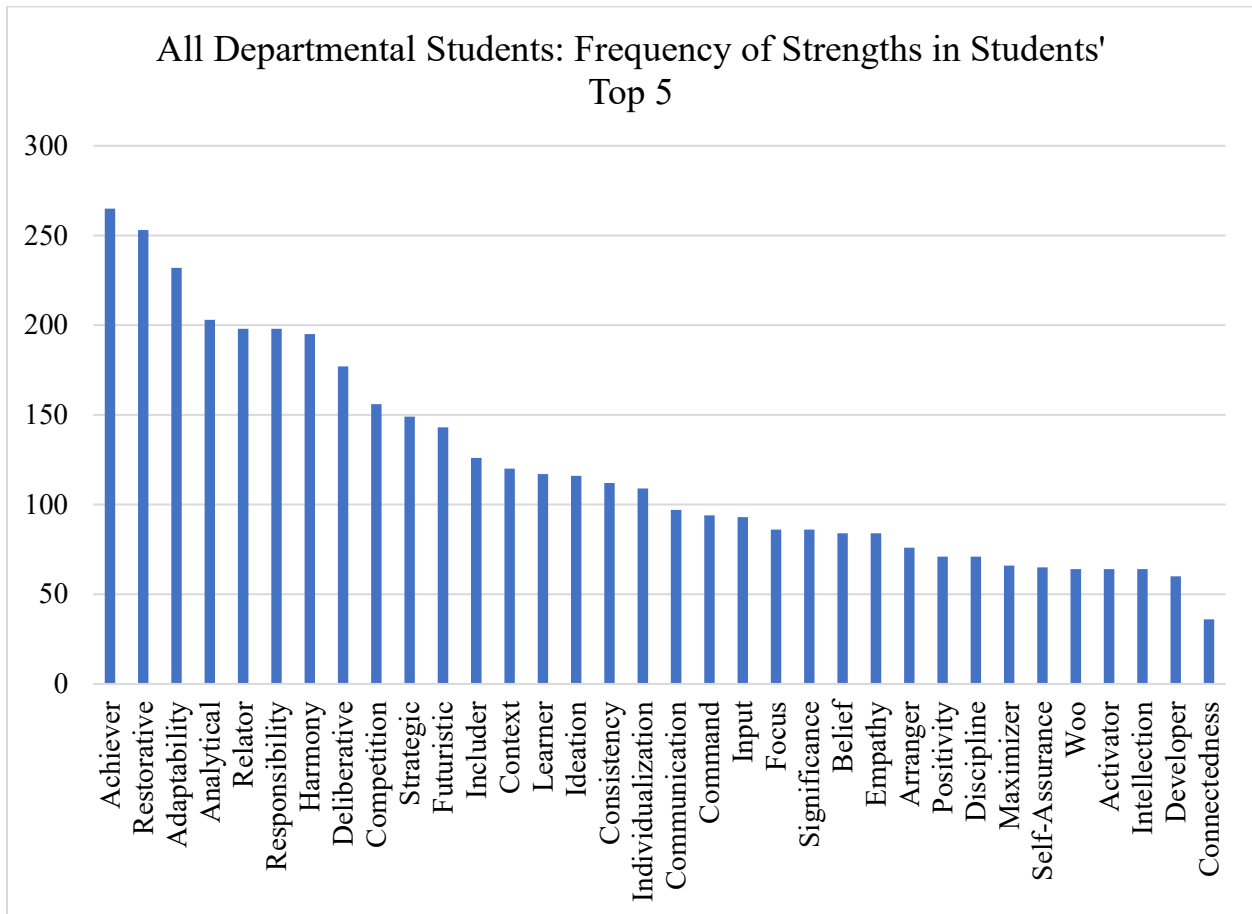


Figure 1. *Strengths frequency chart of all departmental students*

The next group of students was all departmental male students. The five most frequently occurring strengths among departmental males were Achiever, Restorative, Adaptability, Analytical, and Harmony. The five least frequently occurring were Discipline, Activator, Intellection, Developer, and Connectedness. Though there is a clear distinction between the most and least frequent strengths, interestingly, there is nearly linear pattern of decrease in frequency

of occurrence in the top five strengths of male departmental students. Other groups have clear distinctions, or steps, in the transition to most and least prevalent strengths to help identify prominent patterns, but this pattern was not observed with this group of students.

The final departmental group was all departmental female students. The five most frequently occurring strengths were Restorative, Achiever, Responsibility, Adaptability, and Learner. The five least frequent strengths were Maximizer, Command, Connectedness, Self-Assurance, and Significance. Restorative is a clear most frequent strength among departmental females.

Technology majors were the next grouping of students in this research. The five most frequently occurring strengths for technology students were Adaptability, Restorative, Achiever, Relator, and Analytical. The five least frequent strengths were Focus, Discipline, Intellection, Developer, and Connectedness. Intriguingly, all departmental technology students again have the same most frequent three strengths as all departmental students. Adaptability, Restorative, and Achiever are a reoccurring grouping of three that appear to be dominant when viewing students at the departmental and major level. A frequency count of all technology student strengths is shown in Figure 2.

The most five most frequently occurring strengths among the male technology students were Adaptability, Restorative, Achiever, Analytical, and Relator. The five least frequently occurring strengths among male technology students were Focus, Discipline, Intellection, Developer, and Connectedness. Though the most and least frequent strengths can be identified in this grouping, there are few clear breaks in the data to separate the most and least frequent.

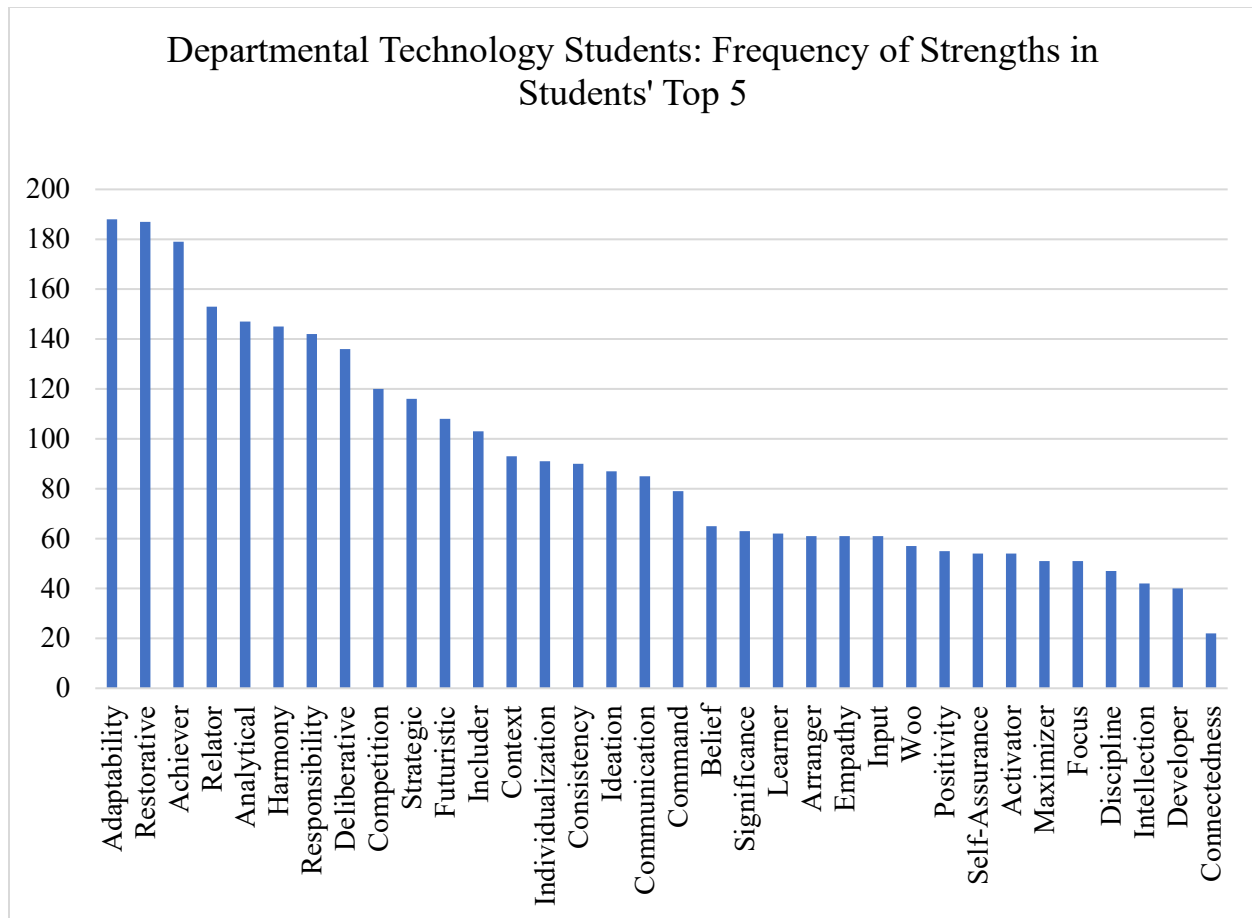


Figure 2. *Strengths frequency chart of all technology students*

The final grouping by major type was for the engineering students. Of all engineering students, the five most frequent strengths were Achiever, Restorative, Responsibility, Harmony, and Analytical. The least frequent five strengths were Arranger, Activator, Communication, Self-Assurance, and Woo, but only Woo has a distinct break from the other low frequency strengths. The frequency of strengths among engineering students' top five appears to be nearly linear apart from a clear most frequent strength, Achiever, which had a large distance between it and the nearest second strength, Restorative. A frequency count of all engineering student strengths is shown in Figure 3.

Achiever, Analytical, Restorative, Harmony, and Responsibility were the top five most frequent strengths of male engineering students. The five least frequent strengths were Arranger,

Communication, Self-Assurance, Activator, and Woo. For this group, there was a clear most frequent strength of Achiever, while the other strengths appeared to decrease in a linear pattern.

Within the female engineering group, the five most frequent strengths were Learner, Achiever, Restorative, Responsibility, and Input. The five least frequent strengths were Self-Assurance, Significance, Communication, Command, and Incluser. There is a clear pattern for the four most frequent strengths within this group: Learner, Achiever, Restorative and Responsibility.

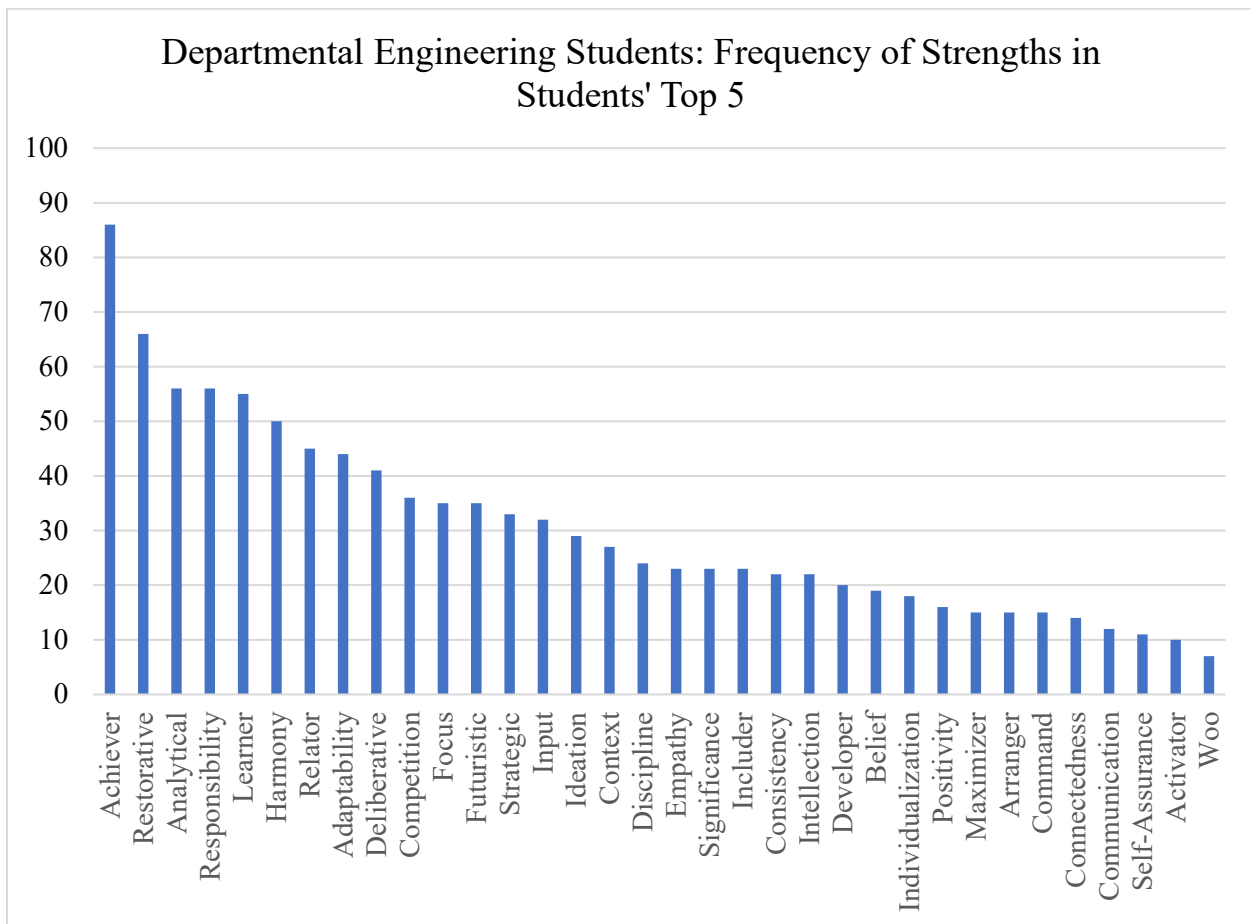


Figure 3. *Strengths frequency chart of engineering students*



Table 2 summarizes the five most and least frequently occurring strengths among each of the groups in this research. In this table there are strengths that occur within and across departmental groups. The most frequently occurring strengths have more patterns across groups than the least frequently occurring strengths. Counts of occurrences for each of the strengths in each of the groups are shown next to the strength.

Across all groups in this research, Restorative was among the five most frequently occurring. Further, Restorative was in the top three most frequently occurring across all groups. There are no other strengths that all groups share in the most frequent or least frequent strengths. Achiever is shared by all groups in the five most frequent strengths except for Female technology students where it is the seventh most frequent strength. Nearly all groups share the least frequent strength of Connectedness. Though engineering students as a whole have Connectedness as a least frequent strength, when splitting the engineering students by gender, connectedness is no longer in the five least frequent for either group due to the different sample sized of each group. For male engineering students, Connectedness moves to the sixth position of least frequently occurring and for female engineering students, Connectedness moves to the seventh position of least frequently occurring.

Table 2. *Most and least frequently occurring five strengths in each group*

Group Description	Most Frequent Five	Occurrences	Least Frequent Five	Occurrences
All Departmental Students N=826	Achiever	265	Woo	64
	Restorative	253	Activator	64
	Adaptability	232	Intellection	64
	Analytical	203	Developer	60
	Relator	198	Connectedness	36
All Male Departmental Students N=732	Achiever	236	Discipline	57
	Restorative	219	Activator	56
	Adaptability	207	Intellection	52
	Analytical	189	Developer	44
	Harmony	176	Connectedness	32
All Female Departmental Students N=94	Restorative	34	Command	6
	Achiever	29	Maximizer	5
	Learner	27	Connectedness	4
	Responsibility	27	Self-Assurance	4
	Adaptability	25	Significance	4
All Technology Students N=619	Adaptability	188	Focus	51
	Restorative	187	Discipline	47
	Achiever	179	Intellection	42
	Relator	153	Developer	40
	Analytical	147	Connectedness	22
Male Technology Students N=578	Adaptability	174	Focus	48
	Restorative	172	Discipline	41
	Achiever	170	Intellection	38
	Analytical	142	Developer	32
	Relator	141	Connectedness	21
Female Technology Students N=41	Restorative	15	Focus	3
	Adaptability	14	Context	3
	Relator	12	Self-Assurance	2
	Deliberative	9	Significance	2
	Responsibility	9	Connectedness	1
All Engineering Students N=207	Achiever	86	Connectedness	14
	Restorative	66	Communication	12
	Analytical	56	Self-Assurance	11
	Responsibility	56	Activator	10
	Learner	55	Woo	7
Male Engineering Students N=154	Achiever	66	Arranger	10
	Analytical	47	Communication	10
	Restorative	47	Self-Assurance	9
	Harmony	40	Activator	6
	Responsibility	38	Woo	3
Female Engineering Students N=53	Learner	22	Self-Assurance	2
	Achiever	20	Significance	2
	Restorative	19	Communication	2
	Responsibility	18	Command	2
	Input	13	Includer	2

When examining the department, Achiever and Restorative are the most frequently occurring strengths. Achiever and Restorative change between the most and second most frequent when splitting the department by gender. Adaptability is also among the five most frequent strengths in both departmental groups. Finally, male students have Analytical and Harmony in the most frequent strengths while female students have Learner and Responsibility strengths among the five most frequent. The only strength in the least frequently occurring category that is shared among males and females at the departmental level is Connectedness. Comparing engineering and technology majors reveals Restorative, Achiever, and Analytical as shared most frequently occurring strengths. Among the least frequently occurring, Connectedness is the only common strength.

For the technology students, three of the five most frequent strengths, Adaptability, Restorative, and Relator, are shared when comparing gender. Males and females differ in that males have Achiever and Analytical in their most frequent while females have Deliberative and Responsibility in their five most frequent strengths. Focus and Connectedness are shared between genders in the technology among the least frequently occurring strengths. Engineering students, when compared by gender, also share three of the five most frequently occurring strengths: Achiever, Restorative, and Responsibility. The engineering groups differ by gender in that males have Analytical and Harmony while females have Learner and Input among their five most frequently occurring strengths. Engineering students grouped by gender also share two of the five least frequently occurring strengths, Self-Assurance and Communication.

When observing males across different major types, technology and engineering, they share three of the five most frequently occurring strengths, Restorative, Achiever, and Analytical. Males across major types do not have any common least frequently occurring

strengths. When comparing Females across engineering and technology majors, two of the five most frequently occurring strengths are shared, Restorative and Responsibility. Females also share two of the five least frequently occurring strengths, Self-Assurance and Significance. Table 3 provides a summary of each group that was compared and the common most and least frequently occurring strengths identified between the groups.

*Table 3. Common strengths between groups*

Comparison group	Most Frequently Occurring Shared Strengths	Least Frequently Occurring Shared Strengths
All groups	Restorative	
Departmental: male vs female	Achiever Restorative Adaptability	Connectedness
Technology major: male vs female	Adaptability Restorative Relator	Focus Connectedness
Engineering major: male vs female	Achiever Restorative Responsibility	Communication Self-Assurance
Major only: technology vs engineering	Restorative Achiever Analytical	Connectedness
Male: technology vs engineering	Restorative Achiever Analytical	
Female: technology vs engineering	Restorative Responsibility	Self-Assurance Significance

Finally, within each group, approximately 70% of students possess one or two of the most frequently occurring five strengths from their group. Over 80% of students within each group have two or fewer of the most frequently occurring strengths. There are some students that

have four or all five of the most frequently occurring strengths for their group. Approximately one out of seven students from each group do not possess any of the most frequently occurring strengths from their group. Table 4 provides a summary of the percent of students with zero through five of the most frequently occurring strengths in each group.

Table 4. *Percent of students with five or fewer of the most frequently occurring five strengths in each group*

<b>Group Description</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>
All Departmental Students	0	0.1	8.4	37.0	39.7	14.8
All Male Departmental Students	0	0.3	9.8	33.3	43.0	13.5
All Female Departmental Students	1.1	0	11.7	35.1	38.3	13.8
All Technology Students	0	0	8.4	36.3	40.1	15.2
Male Technology Students	0	0	8.3	36.7	40.0	15.1
Female Technology Students	0	2.4	14.6	24.4	41.5	17.1
All Engineering Students	0	1.0	16.4	33.8	33.3	15.5
Male Engineering Students	0	1.3	14.3	34.4	37.7	12.3
Female Engineering Students	0	3.8	15.1	39.6	34.0	7.5

## **Discussion**

### **Department Strengths**

A surprising number of common strengths were observed within the department. Six strengths characterize a majority of the departmental students: Achiever, Adaptability, Analytical, Relator, Responsibility, and Restorative. The Restorative strength describes people who enjoy and have an aptitude for solving problems. The Achiever strength is descriptive of people who feel driven to complete tasks and can “power” through tough and rigorous activities without fatigue. Adaptability describes people who like to go with the flow and figure problems out as they come along. Relator describes people who excel at working together with others to complete tasks and that enjoy developing strong relationships with their team. Responsibility is a strength that describes people who take ownership to follow through on what they have

committed to. Finally, the Analytical strength describes a person who uses data and logic as the preferred evidence for decision-making and problem solving (Rath & Conchie, 2008). In summary, the six most prevalent strengths describe the students in the department as responsible and committed problem solvers who develop strong relationships with those that they work with and can handle variability and change in their lives and careers.

A special note is warranted for the strength that carries through all groups, Restorative. This strength describes a person who has an aptitude for solving problems. People with a Restorative strength are energized by identifying the source of the problem and developing a solution or solutions for it. Upon reflection, it is not surprising that this strength was observed among all groups in the department. After all, the department studied as part of this research is an engineering and technology department where all the people are specifically educated on solving problems. The natural talent and desire for solving problems could be what drew the students to the department in the first place.

### **Characterizing Student Groups by Strengths**

When comparing gender differences within the department, males and females shared three of the common top five frequently occurring strengths. The same pattern emerged when comparing genders in the engineering and technology majors. Within each of the majors, engineering and technology males and females shared three of the top five frequently occurring strengths. Though there are some differences in the strengths that each gender possesses, the majority of the top five are the same. This suggests that, within a given major type, there are common strengths regardless of the student's gender that people naturally possess and utilize. This pattern is further extended when examining the differences in a major without considering gender.

Further breaking down the description of Restorative by student groups, Rath and Conchie, (2008) explain that the problems those with Restorative strengths enjoy solving can be conceptual or practical, which likely appeals to both major types in the department. The engineering majors would likely focus on more conceptual and theoretical problem solving, while the technology majors would potentially focus more on practical or applied problem solving. This finding could partially explain why the large transfer rate from an engineering to a technology program. Both groups of students love to solve problems, but the students that transferred from engineering into technology may have found that they were solving problems that they did not enjoy. Regardless of the major or type of problem, the department is clearly generating problem solvers, as shown in the student strengths across all the groups.

Though strengths do not limit a person from pursuing a specific major or discipline, this research suggests there may be evidence of a strengths pattern in groups of people separated by educational discipline. Just as Janke (2015) was able to identify reoccurring strengths across Midwestern universities when focusing on Doctor of Pharmacy programs and Lorimer and Davis (2015) identified a pattern of strengths for students in engineering, there may be reoccurring strengths for students enrolled in engineering and technology programs. There are a large number of common strengths across all the groups in this study.

Lorimer and Davis (2015) found that most prevalent five strengths of engineering students from MacEwan University are Competition, Restorative, Learner, Achiever, and Futuristic. Three of the five most prevalent strengths of engineering students in this research, Achiever, Restorative, and Learner, match those of the research done by Lorimer and Davis (2015). As more data are collected there appears to be more evidence that strengths could be used to describe groups. This means that groups in some situations could potentially be characterized by

strengths and curriculum and other environments could be developed to enhance their education based on these strengths.

The teaching philosophies of the faculty in the study department may also serve as another factor to recruit and retain students. The departmental faculty generally have teaching philosophies that revolve around hands-on and applied problem-solving methods of teaching. Many of the courses offered in the department have laboratory experiences that apply much of the material students learn in lecture. In relation to the most frequent strengths of the department (Restorative and Achiever), applied problem solving teaching philosophies allow the students to exercise their strengths. Specifically, the Achiever strength where students like to feel as if they have accomplished something in combination with the Restorative strength where students have a chance to solve problems to learn material rather than passively absorbing it through lecture.

Though it is possible to characterize the students in this research by their strengths that does not mean they must possess some or all of the most frequently occurring strengths to be successful. This becomes clear when observing the percentage of students in each group who possess none or few of the most frequently occurring strengths. There are approximately one out of seven students in each group that possess none of the five most frequently occurring strengths. Further, there are over 80% of students in each group that possess two or fewer of the five most frequently occurring strengths. These students likely use their strengths in a different way to feel fulfilled and be successful within their program.

### **Conclusions**

This research has shown that there are common strengths within a department even when comparing different groups. This is a similar finding to that of Janke et al. (2015), where it was discovered that five Doctor of Pharmacy programs across the Midwest had three common strengths in each of them. This is also similar to the finding of Lorimer and Davis (2015) who



researched engineering student strengths. Students' strengths profiles can be characterized by gender, department, and major but not entirely. As a whole, there are frequently reoccurring patterns of strengths in the groups but individually, students still bring their own unique talents and abilities to each learning task. The individual aspect of this research can be seen in the fact that over 80% of the students in each group possess two or fewer of the most frequently occurring strengths for their group. This research can be used to further develop curriculum and potentially enhance engagement and retention on a broad scale. However, when working with students individually or in smaller groups, such as class projects, the variety of strengths would likely be much more variable than that of departmental level. This means that when creating groups and teams in class or for projects, there should be consideration for individual contributions to the team or group.

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### **CHAPTER 3. CHARACTERIZATION AND PATTERNS OF ENGINEERING AND TECHNOLOGY STUDENT LEADERSHIP DOMAINS**

Manuscript submitted to: *Journal of Engineering Technology*

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#### **Abstract**

This research investigated the Clifton StrengthsFinder (CSF) leadership domains of engineering and technology students in an engineering department within a large, Midwestern, research-intensive, land-grant university to characterize groups in the department by their leadership domains. In the department, students are taught about strengths as early in their program to help them better understand how to utilize their unique talents to be successful, but limited analysis has occurred on these data. The purpose of this research was to analyze the student strengths data to identify potential patterns of leadership domains among the students. The previous three years of student strengths data were collected and analyzed to identify differences between gender and type of major (technology or engineering) in the department. The number of strengths in each domain and the frequency of dominant domains was analyzed for each group of gender and major. Previous research suggests that there should be no patterns of strengths or best set of strengths for specific majors or on the basis of gender. This research has identified multiple patterns of leadership domains among the different groups in the department. The leadership domain Executing was the most frequently occurring dominant domain across all groups in the department except for technology major females. Technology female students had the most prevalent dominant leadership domain of Relationship building.

## Introduction

The Clifton StrengthsFinder (CSF) has been shown to increase workplace success around the world in industry and academia (Asplund et al. 2014; Cantwell 2006; Tomkovick and Swanson 2014). Cantwell (2006) reported increased student engagement on the basis of attendance, attention, and students seeking information when using a strengths-based education approach. Asplund et al. (2014) reports the use of strengths as a starting point to excelling in tasks. This research is a component of a larger research project exploring the role of strengths in the classroom success of students in an engineering department at a large four-year, public, research-intensive land-grant university. The department enrolls students in two fields of study: technology and engineering. All departmental majors are taught about their strengths early in their degree program. Students are introduced to the CSF to help them better utilize their talents to be successful (Louis 2012).

The engineering and technology degree programs are thought to draw students with similar interests (i.e. in STEM-based problem-solving). The technology programs focus more on hands on and applied aspects of learning, while the focus of the engineering programs is more related to the theoretical and conceptual aspects of learning. Other researchers have explored factors predicting student success in the technology (Mosher 2018) and engineering programs (Kaleita et al. 2016), noting that success predictors differ between the engineering and technology degree programs. Specifically, common academic factors that were significant predictors of GPA for engineering students were not significant predictors of GPA for technology students. Further, there was little difference between engineering and technology student performance on academic indicators such as high school class rank, high school GPA, ACT scores, and placement test scores indicating there is some other factor not being assessed to explain the differences. This led to a hypothesis that students could be characterized by the

Clifton StrengthsFinder to assist in explaining these differences and provide insight into advising and curricular implications.

### **The Clifton StrengthsFinder**

Research exploring a multitude of factors influencing student success has been conducted across the country in several fields of study. Kahu and Nelson (2018) argue that while student retention and success has been widely studied and repeatedly, one factor that often emerges to predict retention and success is student engagement. Furlong, Gilman, Huebner, and (2014) and Seligman and Csikszentmihalyi (2000) focus on positive psychology. They describe how strengths-based initiatives assist students in identifying their talents, leading them to engage in activities that further develop their talents and abilities. There is limited research exploring the connection between successful students and their strengths. By characterizing the CSF strengths of current students, potential patterns of successful students can be identified. This characterization also facilitates more targeted and purposeful instruction, to better allow educators to reach each student by preparing them to approach problems in their disciplinary field using their strengths.

The Clifton StrengthsFinder (CSF) is a tool used by people to measure what they are good at to identify where to focus their efforts to build their strengths (Asplund et al. 2014). In other words, strengths are the mastery of someone's talents through practice and application (Rath and Conchie 2008). When people understand their strengths, they better understand how they can excel in what they are doing rather than just meeting expectations (Louis 2012). Rath and Conchie (2008) argue that if you spend your life trying to be good at everything you will never be good at anything. They describe the CSF as a tool to identify what you are already good at so that you can invest in them to excel in those areas. One can spend time trying to enhance

what they aren't good at but Rath and Conchie (2008) argue this could lead to a person with a long list of mediocre abilities rather than a small list of things you excel at.

The CSF is an online survey tool where participants are given a statement related to common situations and asked to rank how well the statement describes them. These common situations are related to one of 34 different themes, where each theme is a strength. Depending on how the participant answers the questions, the themes will be ranked from most to least prevalent. The top 5 themes, or strengths, are provided to the participant as the result (Asplund et al. 2014). Each of the top 5 strengths that are provided to the participants, can be categorized into leadership domains. There are 4 leadership domains, Executing, Influencing, Relationship Building, and Strategic Thinking (Asplund et al. 2014).

Reliability and validity are important to understand before using a testing methodology such as the CSF (Schreiner 2006). The reliability, human responses remain constant over time, and validity, how well the CSF measures themes of aptitude, of the CSF a factors that may be scrutinized. Schreiner (2006) compared results of the CSF with valid and reliable psychological tests, California Psychological Inventory (CPI) and the 16 Personality Factor (16PF) test. The CPI and 16PF were chosen as baselines comparisons because of their relatedness to the strengths provided in the CSF. Schreiner (2006) describes the appropriate use of the CSF as a tool for personal development and growth as well as providing a foundation for students' development through their college careers.

### **CSF Leadership Domains**

The CSF is not only a tool to provide people with their strengths, it also categorizes strengths into leadership domains. The leadership domains broaden the description of what people are good at as well as how their strengths can be used in leadership roles. Colleges and

universities aim to generate leaders in the fields of study offered within the institution. In reviewing strategic plans for peer universities, many strategic plans include student leadership development as a learning goal (University of Wisconsin 2015; University of Missouri 2018; Iowa State University. Office of the President 2017; University of Nebraska – Lincoln 2015; Purdue. College of Agriculture 2015). Defining leadership as an outcome or goal is prominent throughout academia and education institutions. Institutions strive to teach leadership but do not emphasize the foundation and definition on what leadership means.

The CSF identified the four domains of leadership as Executing, Influencing, Relationship Building, and Strategic Thinking. Leadership domains are broader and better used to describe a person's strengths in terms of contribution to a team than the more detailed 34 individual strengths used as personal development information (Rath and Conchie 2008). The way people use different strengths within the domain will vary but they will all find a way to complete the task presented to them. It has also been found that teams with a distribution of leadership domains form a stronger team (Allen et al. 2013; Rath and Conchie, 2008; Shimazoe and Aldrich 2010). The teams formed with leadership domains in mind are typically stronger because they are diverse in terms of abilities, talents, and in the way people operate.

The Executing domain of leadership is composed of strengths that help people get things done. This type of leader effectively organizes tasks, people, and ideas for efficient and effective completion or use. Leaders in the Influencing domain help to reach out and sell the teams ideas and are the ones that typically act as the spokesperson for the team. People who lead with the Relationship Building domain help to keep the team working together effectively through group organization or individual motivation. They often know how to connect the right people to the right project for optimum completion. Finally, leaders who employ the Strategic Thinking



domain focus on what could be through the reception and analysis of information. They enjoy thinking broadly about the vision and next steps to help the team make better informed choices (Rath and Conchie 2008). The strengths in each leadership domain are shown in Table 1.

**Table 1. Strengths Within Each Leadership Domain.**

<b>Executing</b>	<b>Influencing</b>	<b>Relationship Building</b>	<b>Strategic Thinking</b>
Achiever	Activator	Adaptability	Analytical
Arranger	Command	Developer	Context
Belief	Communication	Connectedness	Futuristic
Consistency	Competition	Empathy	Ideation
Deliberative	Maximizer	Harmony	Input
Discipline	Self-Assurance	Includer	Intellection
Focus	Significance	Individualization	Learner
Responsibility	Woo	Positivity	Strategic
Restorative		Relator	

### **Leadership Domains and Academics**

Kahu and Nelson (2018) have described how student success is linked to engagement. When students know how they can contribute to a team, the team and the students are more engaged and successful. There is limited research on leadership domains in the academic context, although some researchers have identified patterns of strengths based on fields of study. Lorimer and Davis (2015) analyzed engineering students' leadership domains to identify where engineering students could excel on teams and where the shortfalls were. Janke et al. (2015) found similarities in pharmaceutical student strengths across five Midwestern universities as well as differences between genders. Royal et al. (2018) characterized veterinary medicine students to identify "strengths norms". A replication of Royal et al. (2018) was completed by Royal and Huckel (2019) with a different sample and admissions committee that provided evidence to confirm the original research of Royal et al. (2018).

There is currently limited research on the patterns and prevalence of leadership domains. One way of classifying the influence of leadership domains is through the use of “dominant leadership domains” where three or more of the participants’ top five strengths reside in a single leadership domain (Janke et al. 2015). Having a dominant leadership domain implies that the person’s leadership skills will emphasize one “area” of strengths. For example, people with a dominant leadership domain in Strategic Thinking may show their leadership by generating great ideas and plans. Strategic Thinking leaders may have limited strengths in actually executing the ideas they develop or in putting a team together to implement the idea. For this reason, people with a dominant leadership domain may struggle to undertake a project by themselves. On a team, however, these people will likely contribute their strengths in planning and conceptualizing ideas. Placing people on a team with those who lead differently is more likely to result in stronger, more well-rounded teams that can tackle comprehensive projects and complete them on time and within budget (Allen et al. 2013; Rath and Conchie 2008).

Within the department, students often learn through working on teams. More information about student leadership domains has the potential to optimize the teaming experience for both students and instructors (Allen et al. 2013; Rath and Conchie, 2008). Accordingly, the purpose of this research is to characterize and examine the leadership domains of departmental students. Specifically, the purpose is to identify the leadership domains students possess and to determine if there are patterns of dominant leadership domains among students. If patterns of leadership domains emerge, they will serve as the foundation for future research on curricular changes and advising strategies in the department.

## **Research goals**

The distribution of departmental student leadership domains is currently unknown. Thus, this research aims to identify and characterize the leadership domains of the students in the department. The focus is to answer the following research questions:

- What are the leadership domains of the students in the department?
- What are the differences in leadership domain profiles between males and females in the department?
- What are the leadership domain profiles of technology and engineering students in the department?

## **Methodology**

Data were gathered from a required departmental entry level course with mostly freshman and sophomores each semester from Spring of 2016 to Fall of 2018 where students complete the Clifton StrengthsFinder (CSF). Gender information was provided from the registrar's office and included only male and female gender categories. Personal and identifying information was removed from data before analysis. All departmental students who took the CSF in the time frame were included in the data set. Students with majors outside of the department were removed from the data set. Additionally, students with no corresponding academic data were also removed from the data set. The final data set totaled 826 students, after removing 21 non-departmental majors and 1 student without academic data. This research was reviewed by the institutional review board and was declared exempt. The data set was then split into groups by gender and major. These classifications are summarized in Table 2. Analysis was performed on each group to determine patterns and distributions.

**Table 2. Characterization Groups.**

Group Number	Group Description	Number of Students
1	All departmental students	826
2	All Male departmental Students	732
3	All Female departmental Students	94
4	All Technology Students	619
5	Male Technology Students	578
6	Female Technology Students	41
7	All Engineering Students	207
8	Male Engineering Students	154
9	Female Engineering Students	53

To characterize the strengths and leadership domains for each student, the first step was to quantify the number of strengths in each leadership domain for each student. Then, for each student the top five strengths were categorized into domains and the number of the strengths per domain were quantified. This characterization described how many strengths each student had in one of the four leadership domains. It is important to be aware of dominant domains when building teams to ensure teams are diversified in terms of strengths. Each of the groups had a “dominant count” and percentage that was the number of students with three or more of the five strengths in a single domain and the percentage of students who were considered “dominant” in that leadership domain. For example, if a student had Analytical, Deliberative, Learner, Futuristic and Relator as their top five strengths this would translate to three strengths in the Strategic Thinking domain, Analytical, Learner, and Futuristic, one strength in the Executing domain, Deliberative, and one strength in the Relationship Building domain, Relator. Further, because there are three strengths in one domain, this student would be counted as a student with a dominant domain of Strategic Thinking.

## Results

The first characterization was completed at the departmental level, split by gender, summarized in Table 3. The most dominant leadership domain for all departmental students was the Executing domain, with nearly one quarter of students in the department who have a dominant leadership domain fall within the Executing leadership domain. Further, the prevalence of dominant leadership domains across departmental groups, from most to least prevalent, was Executing, Relationship Building, Strategic Thinking and Influencing. When observing students with none of their top five strengths in a given leadership domain, nearly half of students in the department have zero of their top five strengths in the Influencing leadership domain. This pattern continues when observing males and females in the department. In two leadership domains, Relationship Building and Strategic Thinking, the number of male and female students with none of their top five strengths in these domains are nearly equal (approximately 200 students each with no strengths in these leadership domains). With the Influencing leadership domain, nearly twice the number of students have none of their top five strengths in that domain as compared with the Relationship Building and Strategic Thinking domains.

**Table 3. Number of Students with Number of Strengths Per Leadership Domain: All Departmental Students.**

		Executing	Influencing	Relationship Building	Strategic Thinking
All Departmental Students N=826	5 Strengths	3	4	2	2
	4 Strengths	35	12	23	10
	3 Strengths	141	44	102	76
	2 Strengths	235	126	216	209
	1 Strength	274	240	271	309
	0 Strengths	138	400	212	220
	Dominant Count	179	60	127	88
	Dominant Percent	21.67%	7.26%	15.38%	10.65%
Male Departmental Students N=732	5 Strengths	3	3	2	2
	4 Strengths	26	12	21	10
	3 Strengths	126	40	84	63
	2 Strengths	207	116	198	180
	1 Strength	247	223	239	284
	0 Strengths	123	338	188	193
	Dominant Count	155	55	107	75
	Dominant Percent	21.17%	7.51%	14.62%	10.25%
Female Departmental Students N=94	5 Strengths	0	1	0	0
	4 Strengths	9	0	2	0
	3 Strengths	15	4	18	13
	2 Strengths	28	10	18	29
	1 Strength	27	17	32	25
	0 Strengths	15	62	24	27
	Dominant Count	24	5	20	13
	Dominant Percent	25.53%	5.32%	21.28%	13.83%

The second characterization was completed on the department's technology students and is summarized in Table 4. The most dominant domain among technology students was Executing with nearly one fifth of the students having a dominant Executing domain. When observing males and females in technology, the males are most dominant in Executing while the most dominant leadership domain for females was Relationship Building. With males in technology, the most to least prevalent leadership domains were Executing, Relationship Building, Strategic Thinking, and Influencing. For females in technology, the most to least dominant leadership domains were Relationship Building, Executing, Strategic Thinking, and Influencing. Similar to the department as a whole, nearly half of the technology students, both males and females, have none of their top five strengths in the Influencing leadership domain. Further, the remaining leadership domains, Executing, Relationship Building and Strategic Thinking, have approximately 15% to 25% of the students with none of their top five strengths in them relatively different from the approximate 50% of students with none of their top five strengths in Influencing.

The third characterization was completed on the engineering students in the department and is summarized in Table 5. The most dominant leadership domain among engineering students was Executing. More than one quarter of all engineering students hold Executing as their dominant leadership domain. The prevalence of dominant leadership domains for engineering students, from most to least prevalent, was Executing, Strategic Thinking, Relationship Building and Influencing. The engineering students are different from the technology students in that Relationship Building and Strategic Thinking are nearly identical in dominant domain prevalence, approximately 13%. Just as with the technology male and female groups, the least prevalent dominant leadership domain of engineering students is the Influencing

domain. Approximately 60% of all engineering students have none of their top five strengths in the Influencing leadership domain.

**Table 4. Number of Students with Number of Strengths Per Leadership Domain: Technology Students.**

		Executing	Influencing	Relationship Building	Strategic Thinking
All Technology Students N=619	5 Strengths	3	4	2	2
	4 Strengths	28	12	14	6
	3 Strengths	89	31	84	52
	2 Strengths	176	106	167	146
	1 Strength	212	190	206	234
	0 Strengths	111	276	146	179
	Dominant Count	120	47	100	60
	Dominant Percent	19.39%	7.59%	16.16%	9.69%
Male Technology Students N=578	5 Strengths	3	3	2	2
	4 Strengths	23	12	13	6
	3 Strengths	85	31	73	50
	2 Strengths	165	101	157	134
	1 Strength	198	178	195	222
	0 Strengths	104	253	138	164
	Dominant Count	111	46	88	58
	Dominant Percent	19.20%	7.96%	15.22%	10.03%
Female Technology Students N=41	5 Strengths	0	1	0	0
	4 Strengths	5	0	1	0
	3 Strengths	4	0	11	2
	2 Strengths	11	5	10	12
	1 Strength	14	12	11	12
	0 Strengths	7	23	8	15
	Dominant Count	9	1	12	2
	Dominant Percent	21.95%	2.44%	29.27%	4.88%



**Table 5. Number of Students with Number of Strengths Per Leadership Domain: Engineering Students.**

		Executing	Influencing	Relationship Building	Strategic Thinking
All Engineering Students N=207	5 Strengths	0	0	0	0
	4 Strengths	7	0	9	4
	3 Strengths	52	13	18	24
	2 Strengths	59	20	49	63
	1 Strength	62	50	65	75
	0 Strengths	27	124	66	41
	Dominant Count	59	13	27	28
	Dominant Percent	28.50%	6.28%	13.04%	13.53%
Male Engineering Students N=154	5 Strengths	0	0	0	0
	4 Strengths	3	0	8	4
	3 Strengths	41	9	11	13
	2 Strengths	42	15	41	46
	1 Strength	49	45	44	62
	0 Strengths	19	85	50	29
	Dominant Count	44	9	19	17
	Dominant Percent	28.57%	5.84%	12.34%	11.04%
Female Engineering Students N=53	5 Strengths	0	0	0	0
	4 Strengths	4	0	1	0
	3 Strengths	11	4	7	11
	2 Strengths	17	5	8	17
	1 Strength	13	5	21	13
	0 Strengths	8	39	16	12
	Dominant Count	15	4	8	11
	Dominant Percent	28.30%	7.55%	15.09%	20.75%

## **Discussion**

### **Departmental Leadership Domains**

The most prevalent dominant leadership domain for all departmental students is Executing. Even when counting the number of students with at least one strength in each of the leadership domains, Executing is still the most prevalent in the department. What this means for the department is that departmental students are willing to do what it takes to accomplish goals and tasks. The Executing leadership domain is made up of strengths that people use to get things done, generally a trait with positive implications for time management, balance of social and academic obligations, and other factors importance to student success in higher education (Credé and Kuncel 2008; Richardson, Abraham and Bond 2012). However, people who are dominant in the Executing leadership domain may need to be balanced out by other members of their groups because getting things done is only one part of a successful team. A successful team should be composed of people with diverse strengths (Allen et al. 2013; Rath and Conchie 2008; Shimazoe, Aldrich 2010). An example of building a balanced team with someone who is dominant in executing would be to pair them with someone with Relationship Building strengths and Someone with Strategic Thinking. The person with Relationship Building strengths can identify the differences between people with Strategic Thinking strengths and Executing strengths and bring them together on common ground to develop a strong output from the team (Rath and Conchie, 2008; Steger, Mankin and Jewell 2011). This is finding most specifically addresses educators and their methodology to build successful and diverse student groups.

In comparison to the department, Gallup (2019) produced a report for all higher education participant results in the United States. The results of Gallup (2019) identify leadership domains from most to least prevalent as Relationship Building, Executing, Strategic Thinking, Influencing. Overall, in the department the most to least prevalent leadership domain is

Executing, Relationship Building, Strategic Thinking, and Influencing. The students in the department when compared to all higher education students in the United States have nearly the same leadership domain profile except for Executing and Relationship building changing places between most and second most prevalent. Further, Gallup (2018) reports strengths from all people in the United States with the most to least prevalent profile of leadership domains remaining the same as those reported in Gallup (2019) for all higher education students in the united states. This is an indication that the students in this department differ from that of the entire population in the United States and their higher education counterparts.

### **Major and Gender Group Leadership Domains**

Few differences emerge when observing the differences between major and gender. The pattern of Executing being the most prevalent dominant leadership domain is true among both males and females in the department and with both technology and engineering majors. Technology and engineering students both have Executing as the most prevalent and dominant leadership domain, yet there are differences noted between technology and engineering majors. Approximately 20% of technology student have a dominant Executing domain, but nearly 30% of engineering students have Executing as a dominant leadership domain.

Within the technology program, the pattern of most to least prevalent dominant leadership domains are different when comparing male and female students. Unlike females in engineering and males in technology, who have their most prevalent dominant leadership domain in Executing, females in technology have Relationship Building as their most prevalent dominant leadership domain. This suggests that females in the technology program likely approach tasks and assignments differently than their male colleagues. Maltese and Cooper (2017) discovered that K-12 interest in STEM fields can differ between sex based on the type of experiences they

encounter around their interests. Typically, male STEM students enjoy tinkering experiences, taking things apart, while female STEM students enjoyed outdoor exploring outdoor activities. This is suggestive that genders bring different skills and approaches to team-based activities. Maltese and Cooper (2017) did report there were no key differences based on sex of university level students and students rarely cited leaving STEM programs due to lack of interest. This indicates that initial interest developed in K-12 remains intact in college even if the students do not continue to pursue a STEM degree.

Similarly, within the engineering program, differences between male and female students also emerge. Though female engineering students have Executing as their most prevalent dominant leadership domain, the second and third most prevalent differ from male engineering students. Strategic Thinking and Relationship Building leadership domains are ranked second and third, respectively, rather than as third and second, as is true for male engineering students. This finding suggests male and female engineering students approach problem-solving differently and may bring different strengths to the team. This complements the findings of Shapiro and Sax (2011) who identify differences between genders and various aspects of college level STEM programs.

When comparing gender across majors, male technology students and male engineering student have nearly identical distributions of leadership domain strength profiles, with Executing as the most prevalent and Influencing least prevalent. However, when comparing female technology students to female engineering students, the only commonality in order of most prevalent dominant leadership domain is the least prevalent dominant leadership domain: Influencing. The females in technology and the females in engineering have different profiles from the rest of the department as well as from one another. This finding is suggestive that

females, whether in engineering or technology, approach tasks and assignments differently than their male colleagues. The finding also suggests that the problem-solving approach of engineering females may differ from the approach of technology females.

Finally, it is worth noting the least prevalent dominant domain across all groups in this research is Influencing. Not only is the Influencing domain the least prevalent dominant domain, approximately half of all students in each group have none of their top five strengths in the Influencing domain. This means that within the department, it is likely that a limited number of students with a dominant leadership domain in Influencing will be placed on teams. Those with an Influencing leadership domain tend to excel in the promotion, communication, and sales of concepts, ideas, and findings, which in turn can promote the team and its success. Because there are limited students with strengths in this leadership domain, careful attention paid to where these students are placed when building teams or doing group exercises is recommended. As cited in multiple studies (Boiarski 2004; Luisi, Rodgers and Schultz 2019; Rodgers et al. 2018) communication and promotion of ideas has been an increasing need in STEM fields. Placement of students with influencing strengths should be conducted purposefully to help all teams be successful and to help disseminate communication skill among students.

### **Conclusion**

This research sought to identify the leadership domains of departmental students and the relationship with major and gender in an engineering and technology department at a Midwestern, research-intensive, land-grant institution. Across the department, the most common pattern of most to least prevalent dominant leadership domains were Executing, Relationship Building, Strategic Thinking, and Influencing. Though there were no differences at the departmental or major level, differences were found within gender groups in their dominant leadership domain. Females were found to have different leadership domains within and across

majors in the department. Janke et al. (2015) also found that males and females exhibit different leadership domain profiles when researching pharmaceutical students. This implies that future research should build upon this characterization to test patterns and observe changes longitudinally.

Influencing as a dominant leadership domain was not at all prevalent in the department or among any gender or major groups. Although it is not possible to change the strengths and dominant leadership domains of incoming students, more emphasis on communication within the curriculum may be warranted. As a curricular development implication, it is important that students with strengths in the Influencing domain be selected and placed in teams carefully as they have the potential to add value to teams in other way than those with other dominant leadership domains. Further, as they are not as abundant in the department as students with other leadership domains, their placement on teams should be purposeful.

A limitation of this research is that the sample of students covered a span of three years and patterns of domains may change over the next three years. It is important when making decisions to be aware of the current domains of the students. Further, this research is examining patterns at a macro level and strengths can change from semester to semester and from class to class depending on the students. Changes to curriculum at the program level and in the class project level should account for variation from semester to semester and class to class.

Future research should continue to monitor the patterns that emerge in student leadership domains to determine if this is a constant or variable trend to better understand the implications for curriculum development. Constant trends in leadership domains may provide evidence to make curricular changes based to facilitate the leadership domains while variable trends may provide evidence against curricular changes. Further, future research should examine the

development of teams with different leadership domain profiles to assess their ability to complete different projects and coursework. Testing different team combinations based on leadership domain would provide insight into how teams function within this department's students.

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## CHAPTER 4. STRENGTHS AND SUCCESS: TECHNOLOGY AND ENGINEERING STUDENT PERCEPTIONS

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### Abstract

Strengths have been hypothesized to play a role in how a person approaches leadership and problem-solving. The Clifton StrengthsFinder (CSF) is a common way to identify and measure an individual's strengths. This research examined the role of CSF strengths in the academic success of engineering and technology students within a large, Midwestern, research-intensive, land-grant university. Students are taught about strengths as part of a required sophomore-level course to help them better understand how to utilize their unique talents to be successful, but limited analysis has occurred on these student strengths data. The purpose of this research was to identify how students use their CSF strengths and to identify if students perceive a connection between strengths and their success. This research used a survey to gather broad information on students in the department and utilized interviews to gather detailed qualitative information on student perceptions. The survey and interview collected demographic information, GPA, student perceptions of where strengths are useful, and student perceptions on the level of understanding and usage of strengths. Students perceived that there were a set of strengths that allows some students to be more successful than others. However, one-way and Factorial ANOVA tests identified no significant connections between student GPA and the students use and understanding of CSF strengths. Students perceive CSF strengths are useful in group academic tasks but not useful in individual academic tasks. Based on student responses in

the interview and survey it would seem students may not be aware that they are using their strengths in some scenarios.

### **Introduction**

Strengths have been hypothesized to play a role in how a person approaches leadership and problem-solving. The Clifton StrengthsFinder (CSF) is a common way to identify and measure an individual's strengths. Understanding one's strengths has been shown to increase workplace and academic success around the world (Asplund et al. 2014; Cantwell 2006; Tomkovick and Swanson 2014). Yet, little research has examined how people use their strengths to increase their success. This research explored the role of strengths in the classroom success of students in an engineering department at a large four-year, public, research-intensive land-grant university. The department included students in two fields of study: technology and engineering. Since 2015, departmental students have been taught how to utilize the information from the Clifton StrengthsFinder because it was hypothesized to help them better utilize their talents and natural aptitudes to be successful academically (Louis, 2012).

Fields of Science, Technology, Engineering, and Mathematics (STEM) are often competitive and require high academic performance from students. This frequently results in some students exiting STEM fields before graduation (Kaleita et al. 2016; Geisinger and Raman, 2013; Rask, 2010), yet the reasons students leave are not always academic (Maltese & Cooper, 2017). Other research has explored factors predicting student success in technology (Mosher, 2018) and engineering programs (Kaleita et al., 2016). Published research has suggested that success predictors may differ between students in engineering degree programs versus those in technology degree programs. Specifically, common academic predictors such as ACT test scores that were important in determining engineering student success were not significant predictors of GPA for technology students.

This is an interesting finding, given that departmental majors in technology and engineering majors are similar curricular-wise, with both revolving around STEM-based problem solving. While technology degree programs are not as math or physics intensive as the departmental engineering degree programs, both the departmental engineering and technology programs focus on solving problems using math and science and emphasize critical thinking and analysis. Technology degree programs generally focus more on hands-on learning and applied aspects of learning, while the focus of the engineering programs has more theoretical and conceptual aspects of learning. Entrance data trends suggest that differences in academic indicators such as high school class rank, high school GPA, ACT scores, and math placement test scores were small between technology and engineering students. One hypothesis is that some of the differences in academic performance among students in engineering and technology fields could be related to student strengths.

### **The Clifton StrengthsFinder**

The Clifton StrengthsFinder is a tool used to measure how people think, feel, and behave in various scenarios and provide guidance on how to better employ one's natural talents to continuously improve (Asplund, et al. 2014). Strengths drive the mastery of an individual's talents through practice and application (Rath & Conchie, 2008). The CSF tool assists individuals in discovering their natural talents and provide a starting point for exploring them. As individuals learn about and explore their talents, they better understand how they can add value to a task rather than simply meeting expectations (Louis, 2012). The CSF has been employed in various ways to better understand the dynamics of the workplace and the development of strengths with students, families, and organizations (Asplund et al., 2014).

When participants complete the CSF, they are presented with an online survey that asks a series of questions related to common situations. For each of the questions, participants are asked to rank how well various responses describe them in the various situations. The responses to the common situations are related to one of 34 themes, termed a strength. When the participant completes the survey, the themes are ranked from most to least prevalent, based on how the participant responded to each of the common situations presented. The top five themes are presented to the participant as their top five strengths (Asplund et al., 2014).

The Reliability and validity of a testing methodology such as the CSF are important to understand before using such a method (Schreiner, 2006). Human responses remaining constant over time, the reliability, and how well the CSF measures themes of aptitude, the validity, of the CSF may be scrutinized. Schreiner (2006) analyzed the results of the CSF with known valid and reliable psychological tests, the California Psychological Inventory (CPI) and the 16 Personality Factor (16PF) test. The CPI and 16PF were chosen as baselines comparisons because of their relatedness to the strengths provided in the CSF. Schreiner (2006) describes the appropriate use of the CSF as a tool for personal development and growth as well as providing a foundation for students' development through their college careers.

### **Strengths, GPA, and Success**

Student retention and success has been widely studied. Student engagement is a common factor often connected to retention and success across many fields of study (Kahu & Nelson, 2018). On engagement, Furlong, Gilman, Huebner (2014) and Seligman and Csikszentmihalyi (2000) described how strengths-based initiatives assist students in identifying their natural talents leading to higher engagement in activities and that further develop these talents. Further, Soria and Stubblefield (2015) found that first year students with higher levels of strengths awareness,

as measured by Anderson's (2004) strength's awareness measure instrument, were positively associated with higher levels of student retention. Published research has provided evidence that strengths can promote classroom engagement and student retention, which may eventually lead to academic success. However, existing research has not explored the "how" behind these higher levels of academic engagement and retention by asking students how they use their strengths to support their academic success.

There has been some research related to success in terms of GPA and CSF strengths in the field of engineering. Lorimer and Davis (2015) found that students in an engineering program with more engineering-oriented strengths had a significantly higher GPA than those with fewer. The engineering-oriented strengths in Lorimer and Davis (2015) were defined as Clifton StrengthsFinder strengths paired with traits identified as abilities and expertise in the Engineer of 2020 published by the National Academy of Engineering (NAE, 2005). As an example of the connection made between engineering attributes and engineering-oriented strengths, Analytical and Restorative are strengths paired with the attribute "analytical skills. Lorimer and Davis (2015) found that engineering students with more "engineering strengths" were more likely to earn a higher first year GPA.

However, the connection between strengths and GPA is not entirely related to academic success. Success has many facets and cannot be defined by a single variable such as GPA. Often, success looks different for each person, organization, or university (Delahunty & O'Shea, 2019). For example, recent research determined how to predict student success by exploring number of courses taken, departments, and grades with modern statistical methods, such as the use of random forests in conjunction with classification trees (Beaulac & Rosenthal, 2019). In this research, "success" is defined individually by students, rather than by comparing their

achievement to a universal definition of success. Further, the student's definition of success is not of high importance in this study. Instead, the research examines how students use their CSF strengths to optimize their performance in the classroom, on the job, and in other professional settings.

There has been limited research on the topic of how students use their strengths to be successful academically. Lopez and Louis (2009) describe a strengths-based education approach that focuses on student talents to succeed rather than improving their "deficits". Cantwell (2006) shares a similar approach of building a classroom around each of the students' strengths. Schreiner (2010) describes how the use of strengths in the classroom can move students from surviving and graduating to thriving in their programs. However, there is no descriptive or empirical measurement of how students use their individual strengths in the classroom to improve their academic performance.

### **Research goals**

The main objective of this research was to identify how students are using their strengths and if they perceive a connection between their strengths and their success after taking the CSF. This provides a baseline to understand how students are using the strengths-based educational model they have been taught to enhance their academic success. The research aims to answer the following questions:

- How have students used their strengths during their academic experiences?
- What influence does student understanding and use of strengths have on student academic success?
- Is there a relationship with use and understanding of strengths and student GPA?

## **Methodology**

This research was reviewed by the institutional review board, IRB ID18-496, and was declared exempt from further review. A concurrent mixed methods approach was used to gather complementary quantitative and qualitative data on student demographics and perceptions. To quantify departmental student perceptions on their strengths, an electronic survey instrument was sent to all departmental students by email. The survey had a classification question to determine if the students had already taken the Clifton StrengthsFinder (CSF) after they entered their demographic and GPA information. If the student had not taken the CSF, the participant would be taken to the end of the survey and not be asked any strengths perception related questions.

Participants were asked demographic questions about their major, GPA, gender, how well they knew their strengths, and how they used their strengths. In the survey, participants were asked to briefly describe experiences related to their strengths. This survey provided the opportunity to gather a dataset of quantitative student data for later comparison with qualitative student data across all majors in the department.

A semi structured interview was conducted with students to ask more in-depth questions about how students use their strengths. In their review paper, Kallino et al. (2016) described the semi structured interview as a common qualitative data collection method that allows for versatility in the interview process by allowing the researcher to ask follow up questions based on participant responses. The semi structured interview process provides a flexible method of inquiry on student perceptions of strengths and success. In our study, participants were selected in a quota sampling method (Gideon, 2012). The sample intentionally included participants from each major type, engineering and technology, and from different genders to provide information that was representative of the department's population. The participants were identified conveniently by the researcher approaching them in class to describe the research to them and



asked if they would like to set up a time to discuss it in more detail. The interview asked similar questions to the survey but provided the opportunity to pose follow up questions to participant responses. Each of the interviews were recorded and transcribed to analyze the responses from each of the participants. The responses to each question were summarized into themes for each of the participants. Initially, four pilot interviews were conducted with the purpose of determining if the interview was providing the needed information and to familiarize the interviewer with the interviewing process. Eight additional interviews were conducted after the pilot interviews.

### **Student use of strengths in academics**

To investigate how students have used their strengths in their academic pursuits, survey data and interview data were used. In the survey, participants were asked where they used their strengths in academics. The options provided on the survey included projects, homework, tests/exams, group related activities/projects, labs, and a box for the participant to provide any additional areas. After the participants were asked how they use their strengths in academics, they were asked to briefly describe how they used their strengths in the areas they selected.

To elucidate on the brief descriptions that participants provided in the survey on how they use their strengths in academics, the interview data were used to explore more detailed responses. The first question related to using strengths in academics prompted the participants to describe how they thought strengths were useful or not in terms of academic coursework. The next several questions focused on asking participants to describe situations where they used their strengths. Participants were then asked to describe difficult and easy academic-related individual tasks without any reference to strengths to determine if their responses still described the use of their strengths. Similarly, the participants were then asked to describe difficult and easy group or

team based academic related tasks, a question intended to elicit more information on how students use their strengths. An example of questions posed to students include: Can you describe a specific situation where you used your strengths? Can you provide an example of a difficult task and an easy task from a course? The full survey and interview questions are provided in Appendix A and Appendix B.

### **Student perceptions of strengths and academic success**

Defining academic success universally can be challenging because the definition of success may vary for different people. Rather than trying to measure success of students through a derived definition, survey participants were simply asked to rank the helpfulness of strengths in their academic success on a scale of zero to ten where zero was not helpful and ten was very helpful. In conjunction with this question, participants were also asked to rank how helpful strengths were in their personal life success and career success on a scale of zero to ten. This provided a perspective on how students viewed the helpfulness of strengths in academics relative to other aspects of their lives. A one-way ANOVA was used to determine if participants perceived the usefulness of strengths in success differently in their academic, personal, and career pathways.

In the interview, participants were also asked if they believed there were a set of strengths that makes students more or less successful in their major or specific courses. This question provided the opportunity to explore what the participant believed success was and how the strengths were or were not connected to success. To provide further insight on what students believe success is, participants were asked to describe characteristics of a successful student and a successful team.

### **Use and understanding of strengths and GPA**

The next part of the research focused on the quantitative values to determine if students that understood and actively used their strengths had a different GPA than those who do not. In the survey, demographic questions asked participants what their overall and core GPA was. The core GPA references the courses students are required to take specific to their major. Participants were also asked to select one of five options that best describe their understanding and use of strengths. This question provided the ability to group participants in specific levels of understanding and use of strengths. Each level of use and understanding was coded from 1 to 5 where: 1 was I have never taken the Clifton StrengthsFinder survey, 2 was I do not understand my results, 3 was I understand my results but I do not apply my understanding of them to be more successful, 4 was I understand my strengths and sometimes apply my understanding of them to be more successful and 5 was I understand and apply my understanding of my strengths to be more successful. If a student selected a ranking of 1, the student would then be taken to the end of the survey as all following questions were related to perceptions of strengths.

The survey data was used in two one-way analysis of variance (ANOVA) models to determine if students who ranked their usage and understandings of strengths differently had different overall and core GPA. The first model was created with core GPA as the dependent variable and student ranking of use and understanding of strengths as the independent variable. The second model utilized overall GPA as the dependent variable and student ranking of use and understanding of strengths as the independent variables. Further, to explore potential interactions with other variables, two Factorial ANOVA models with other categorical demographic variables were developed with core and overall GPA as the dependent variable. Independent demographic variables included in the second iteration of the model were major, whether the

participant has changed majors, classification, and gender. Changed majors was input from the yes-no question in the survey that asked students if their current major was their first major. Yes, indicated that the student did not change majors while no indicated the student has changed majors. Each of the independent variables were included in the model as interactions with the student ranking of use and understanding of strengths.

## **Results**

There were 93 students that participated in the survey, with 68 completing the survey. Incomplete surveys were removed from the data set. Of the 68 participants, there was nearly equal representation from each of the majors in the department, 32 engineering students and 36 technology students. In terms of classification, there were 37 seniors, 13 juniors, 14 sophomores, and 4 freshmen. For gender, there were 11 females and 57 males. The interview portion of the data collection process included eight participants, with five technology students and three engineering students. Seven seniors and one junior took part in the 30 to 60-minute semi-structured interview sessions.

### **Student use of strengths in academics**

From the survey data, participants were asked where they used their strengths academically. Participants could select any and up to all of the options provided as shown in Table 1 to indicate where they use their strengths. Only 22 participants chose to complete this section of the survey. The most frequently occurring categories of where participants used their strengths academically were either in projects or group related activities as shown in Table 1. The percentage in Table 1 is the count and percentage of the total selected categories from all 22 participants.

Table 1. Learning Categories Where Participants Use Their Strengths

<b>Categories</b>	<b>Number (percentage) of participant selection</b>
Projects	44 (32%)
Group Related Activities/Projects	40 (29%)
Labs	21 (15%)
Homework	18 (13%)
Tests/Exams	15 (11%)
Other	0 (0%)
n=22	

The next question asked participants to briefly describe how they used their strengths in the categories they selected. Participants less frequently perceived they were using their strengths on individual assignments or reoccurring tasks such as homework. There were 22 participants that described how and where they used their strengths, with two of the participants describing multiple scenarios, resulting in 24 detailed responses. The themes of responses from participants overwhelmingly described group or team situations. The themes of scenarios participants described using their strengths are shown in Table 2. The two top themes of the responses are either participants describing how they lead the group or knowing where to fit in the group. The percentage in the table is the percentage of total themes derived from the participant responses.

Table 2. Themes of How Participants Use Their Strengths

<b>Themes of participant response</b>	<b>Number (percentage) of theme occurrence</b>
Know how or where to contribute	9 (38%)
Delegate tasks or manage	7 (29%)
Know how to work together	5 (21%)
Confidence in work	3 (13%)
n=22	

During the interview, participants were asked to describe situations where they thought strengths were useful and situations where strengths were not useful. Of the eight responses, three of the participants stated that strengths were useful in some form academically, four did not perceive them as academically useful, and one participant was indifferent on the subject and could not decide whether or not knowing one's strengths was useful in terms of coursework. Of the three that perceived strengths as useful for academic work, two perceived strengths as only being useful when working with others. Only one interviewee described strengths as being useful for individual work. For example, one participant describing how strengths were useful in groups said:

*"I think that you can apply these more to like a group setting to get a group that would mesh better kind of play off each others strengths and weaknesses. I think just kind of like alone it still has value but, in my eyes, I think it loses its value outside of a group".*

Another participant stated they were useful and when asked why, said:

*"Because it allows me to attack the problem in the way that I know I am going to be able to understand and learn at the same time."*

The participant interview responses provided information similar to that of the survey responses in that students more frequently use their strengths in group related tasks. However, there are still some students, just as the survey indicated, that find strengths useful when approaching individual tasks.

Four participants characterized strengths as unnecessary to academic success, whether it was in group work or individual work. Three of the participants who perceived that strengths were unnecessary all had the same reasoning to support their belief. These participants did not

believe that knowing or understating one's strengths was necessary, because they felt that a person already knows what he/she/they are "good at" and that strengths tests were just an educated way to describe what an individual is "good at" to others. For example, one participant stated:

*"your strengths are your strengths... they are just there it doesn't matter if you're just putting a label on them... I know what I'm good at even if it's not classified in the StrengthsFinder and I know what I need to do to succeed."*

The fourth participant felt that strengths were only useful in the workplace. Finally, one participant was indifferent on the subject and could not decide whether or not knowing strengths was useful in terms of coursework. The person's indifference on the topic suggests a low level of usage of strengths. These interview responses provided a greater understanding on what drives student perceptions of the understanding of strengths as unnecessary. For the students who do not perceive them as helpful, they believe they already understand what their strengths are and don't need an assessment tool to tell them.

The next question asked participants to describe a specific situation where they knew they were using their strengths. Six of the eight participants were able to describe a scenario where they knew they used their strengths. One of the participants described being able to use strengths to both improve processes at work and handle family situations. Another participant described how they use their strengths in student club leadership and in keeping course projects on track by communicating with people. The third participant described using strengths in a group project to move everyone forward in a scenario where the team was stuck on unnecessary project details. The fourth participant described using their strengths to resolve disputes within groups, to keep on track with their homework, and to plan ahead in completing coursework. The

fourth participant described how they used their strengths to take charge and make decisions for those in group projects that were indecisive. The fifth participant described how they use their strengths to relate to and include people in groups, repeatedly complete tasks at a high level, and adapt to new situations readily. The final participant described how they use their strengths to find ways to talk through conflict resolution in group projects. The most repetitive theme across responses for this question was that the students chose to describe situations of working with others when they knew they were using their strengths.

The final interview questions asked participants to describe an easy and a difficult task to complete. This question was used to determine if the individual described the application their strengths for the tasks they chose. If the participant strengths were known from the interview, a connection between their description and their strengths was investigated. One of the participants described an easy task as one where they knew what they were doing. Because they knew what they were doing, their interest in the task encouraged individual research on the topic.

*“I just got so deep into it and I studied outside of class and I put “studied” in quotations in that I looked up videos on what other people did and looked up oh what does this one do and what’s easier ways to do it because the teacher kind of hinted at well there’s an easier way to do this but I’m not going to tell you yet and it got me intrigued and so I figured it out before we were supposed to do it which in turn kind of helped me study.”*

This situation describes how the participant was likely applying their Learner strength to seek out new information on the subject. Another participant with a Maximizer strength described tasks related to saving time and money as easy. Multiple participants described situations that didn’t have explicit instructions or enough background material applied as being difficult. Following



the CSF model of building teams with diverse strengths, lacking explicit instructions or information may make situations difficult for some people but can be seen as a non-issue for others. These interview responses provided insight into how the usage of strengths could be helpful in understanding factors driving student academic success.

### **Student perceptions of strengths and academic success**

To determine if students perceived a connection between academic success and their knowledge of CSF strengths, participants were asked to rate how helpful knowing their strengths is in helping them to be successful. Participants were also asked how helpful knowing their strengths was in their academics, career and personal life. A one-way ANOVA was conducted to determine if students perceived a difference in the usefulness of knowing their strengths for in their academics, career and personal realms. In total, 48 participants provided a usefulness rating in each of the three categories. Table 3 displays the mean values from the participant responses. The means describe the most to least useful strengths as Career, Personal Life, and Academics. Table 4 displays the ANOVA results and shows that though participants on average rated the three groups differently there was no significant difference between the groups.

Table 3. Means for One-Way ANOVA on usefulness of strengths in academics, career, and personal life

Useful In	N	Mean	Standard Error	Lower 95%	Upper 95%
Academics	48	6.8125	0.34182	6.1367	7.4883
Career	48	7.75	0.34182	7.0742	8.4258
Personal Life	48	6.89583	0.34182	6.2201	7.5716

Scale: 0 to 10 where 0 is not helpful at all and 10 is very helpful

Table 4. Analysis of variance on usefulness of strengths in academics, career, and personal life

Source	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P Value
Usefulness	2	25.84722	12.9236	2.3043	0.1036
Error	141	790.79167	5.6085		
Corrected Total	143	816.63889			

In the interview, participants were asked to describe what a successful student is and characteristics of a successful student. Of the eight interview participants, none mentioned GPA as an indicator of a successful student. Two of the participants specifically stated that grades were not a measure of success. One participant stated:

*“I guess a successful student in my mind is just getting through and getting your degree. I know there’s a lot of people that think a successful student is a 3.0 and there’s a lot of companies that think that too, but I disagree.”*

Six of the eight participants commented that a successful student effectively applied the learned material in their life after college. For example, one participant stated:

*“I would describe a successful student as anyone who takes in the material and retains it as much as possible and leaves college with as much material and as much connections as they possibly could have gotten. I don’t think grades are necessarily the most important thing in the world because anyone can get good grades it’s really about did you actually learn something, was your time here worth it. If you weren’t spending your time here to actually improve yourself then in my opinion it was wasted.”*

Participants described how a person was successful when learning and that failing to learn something to use in the future was a waste of time. Overall, students do not perceive a connection between GPA and success. Although some participants could not name specific strengths that are related to success, they were able to describe the traits that they thought would make some students more successful than others. Strengths explicitly stated in the interviews included: strengths in strategic thinking such as ideation and adaptability. Strengths assessed from the traits described by participants included relator, analytical, command, and arranger. One

of the participants described how success depends on the combination of one's strengths or how someone might use individual strengths in a unique way, rather than just having a specific set of strengths

On the same topic of success, participants were asked to describe a successful team. A common theme among the responses was the ability to communicate effectively to get things done. Five participants mentioned that team members needed to be able to communicate about where each member of the team was strongest. In describing a successful team, one participant stated:

*"I think regardless of your role, communication is what's going to make or break your team because you can have a bunch of people on there with different skills and everyone can play to those skills but if you're not communicating what those skills are and what you can do ... well, you're probably just going to get whatever the group gives you and you may not be good at it and things can snowball from there."*

Though there was no mention of strengths, participants identified that ability to identify who was good at what when working together as part of a successful team. Similarly, in a previous question where students were asked to describe a situation where they knew they were using their strengths, students mentioned team tasks that would be relatable to strengths, but no specific strengths were mentioned in the previous responses. These interview responses provided information on how students readily identify "who is good at what". Yet, it is clear they do not use strengths to make these assessments.

### Use and understanding of strengths and GPA

This part of the research was focused on determining if a relationship existed between change in the use and understanding of strengths and student GPA. Four models were created to test the relationship between core GPA and overall GPA. Two one-way ANOVA models utilized student rankings of use and understanding of strengths to compare means of core and overall GPA. Two Factorial ANOVA models added other demographic variables to compare means of core and overall GPA. In the four models, no significant differences were identified.

The first one-way ANOVA model included use and understanding of strengths as groups for mean core GPA. There were 66 participants that reported their core GPA and of those students, none selected the 2 ranking of use and understanding of strengths. Figure 1 displays the box plots of the groups. Table 5 displays the analysis of variance table where no significant differences were identified between groups.

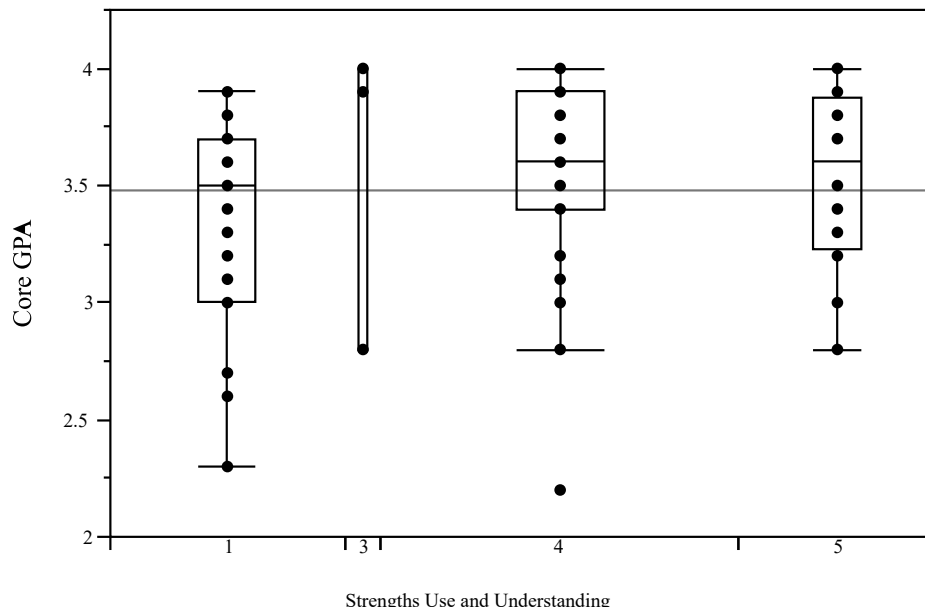


Figure 1. Core GPA by Strengths Use and Understanding Box Plot

Table 5. Analysis of Variance of Core GPA by Understanding and Use of Strengths

Source	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P Value
Model	3	0.675712	0.225237	1.1522	0.3351
Error	63	12.315034	0.195477		
Corrected Total	66	12.990746			

The second one-way ANOVA model included student ranking of use and understanding as groups to compare overall GPA. There were 67 participants that reported their overall GPA. Figure 2 displays the box plots of the groups. Table 6 displays the analysis of variance table where no significant differences were identified between groups.

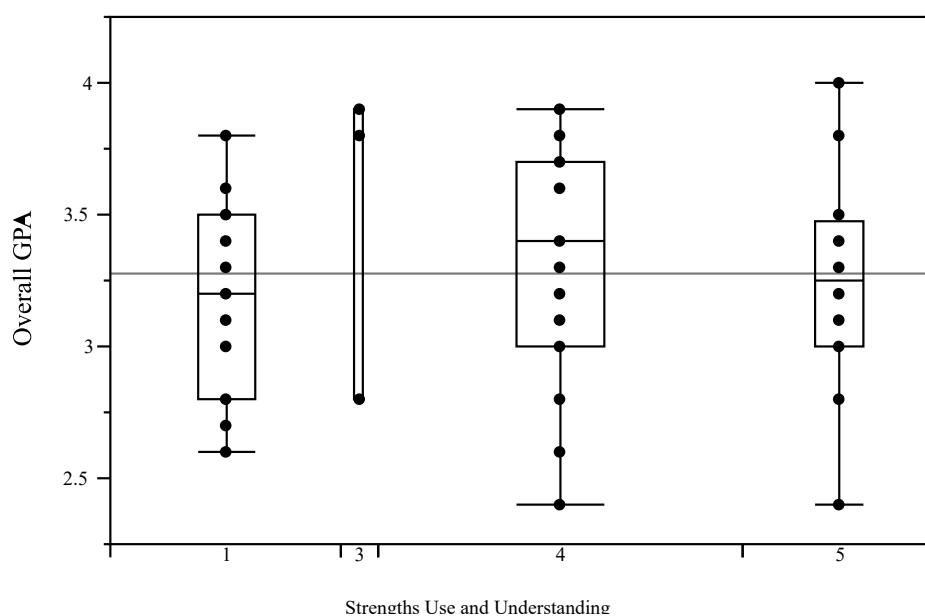


Figure 2. Overall GPA by Strengths Use and Understanding Box Plot

Table 6. Analysis of Variance of Overall GPA by Understanding and Use of Strengths

Source	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P Value
Model	3	0.334978	0.111659	0.5961	0.6198
Error	64	11.987375	0.187303		
Corrected Total	67	12.322353			

The third model was a Factorial ANOVA model that used student ranking of use and understanding of strengths, major, gender, classification, and interactions between use and understanding with each of the demographic variables as groups to compare mean core GPA. Sixty-six participants reported core GPA and demographic information. Figure 1 above displays the core GPA by use and understanding of strengths box plot. Figures 3 through 6 display the box plots of the demographic variables by core GPA. Table 7 displays the analysis of variance table where there were no significant differences identified between the groups.

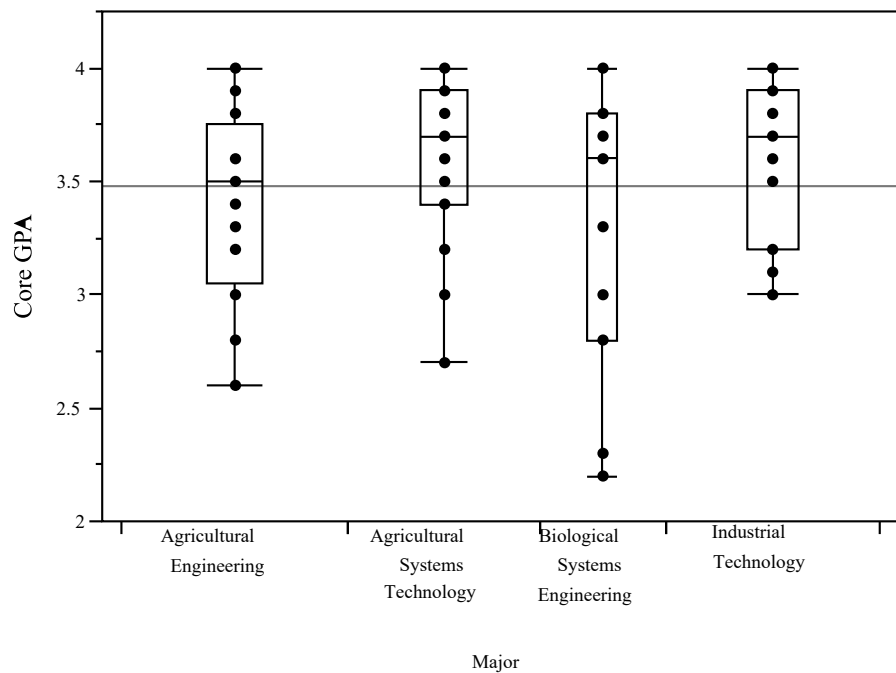


Figure 3. Core GPA by Major Box Plot

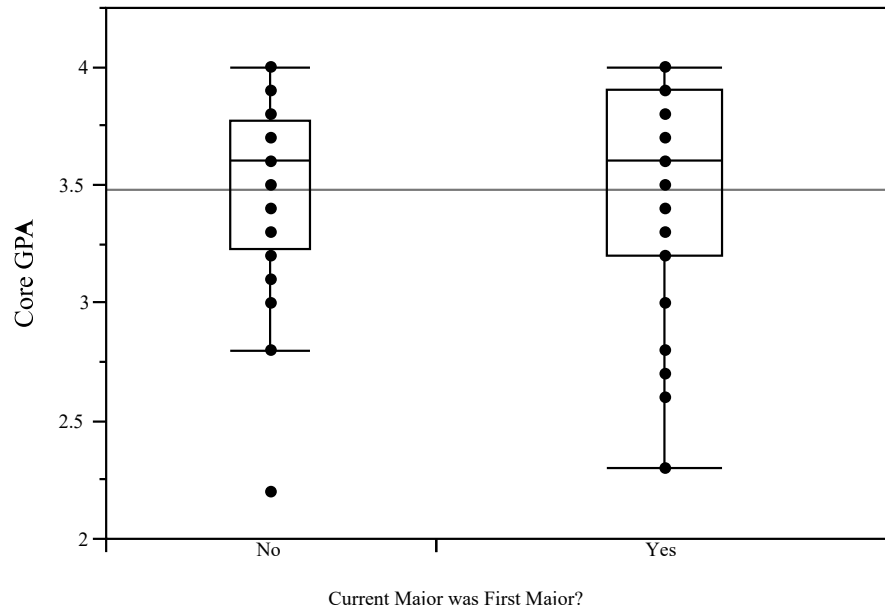


Figure 4. Core GPA by Current Major as First Major Box Plot

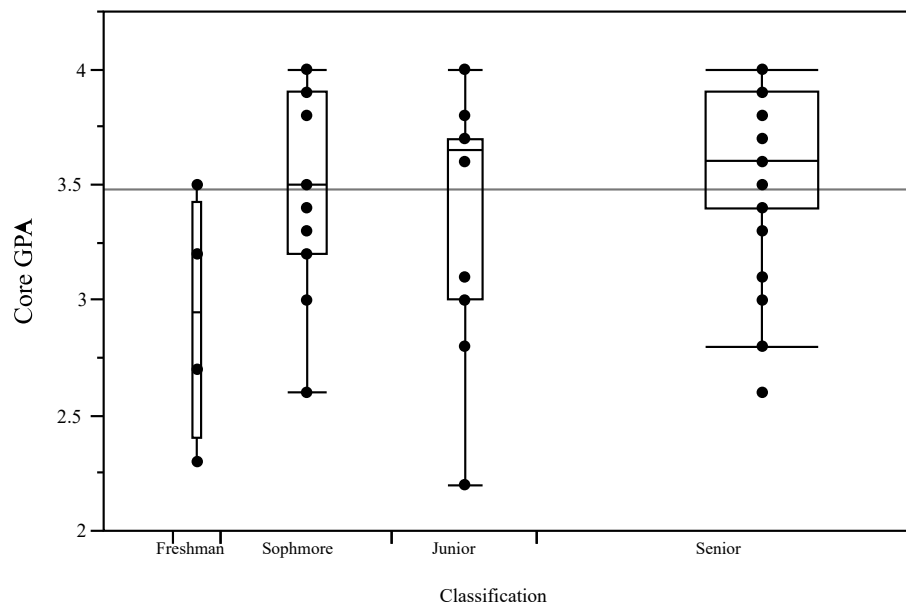


Figure 5. Core GPA by Classification Box Plot

Table 7. Analysis of Variance of Core GPA by Demographics and Understanding and Use of Strengths

Source	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P Value
Model	27	6.063589	0.224577	1.2644	0.2473
Error	39	6.927158	0.177619		
Corrected Total	66	12.990746			

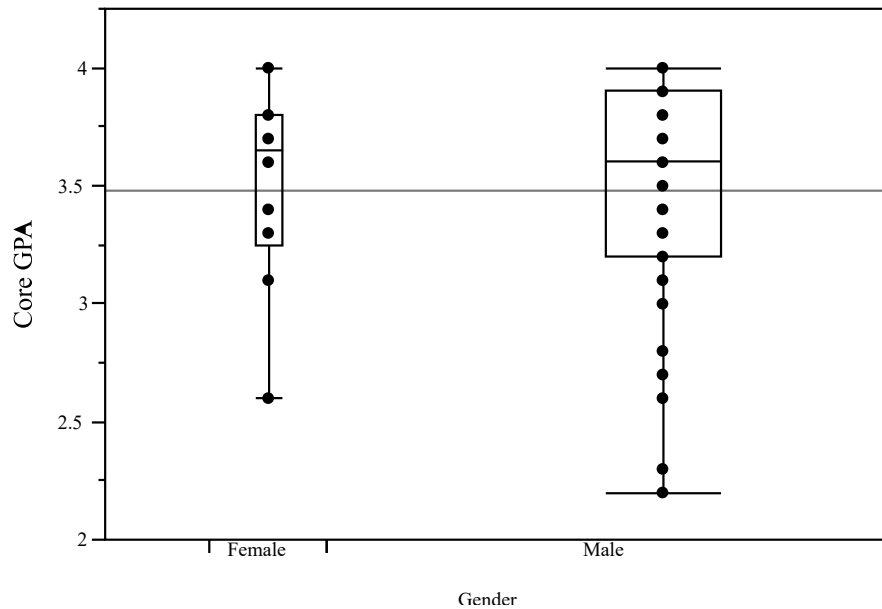


Figure 6. Core GPA by Gender Box Plot

The fourth model was a Factorial ANOVA model that used student ranking of use and understanding of strengths, major, gender, classification, and interactions between use and understanding with each of the demographic variables as groups to compare mean overall GPA. Sixty-seven participants reported overall GPA and demographic information. Figure 2 above displays the overall GPA by use and understanding of strengths. Figures 7 through 10 display the box plots of the demographic variables to core GPA. Table 8 displays the analysis of variance table where there were no significant differences identified between the groups.



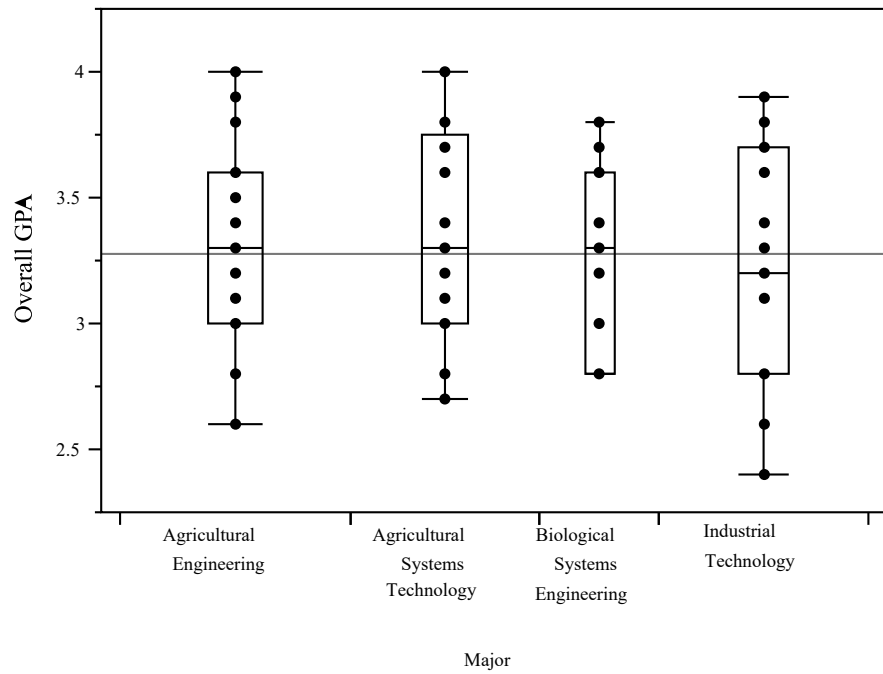


Figure 7. Overall GPA by Major Box Plot

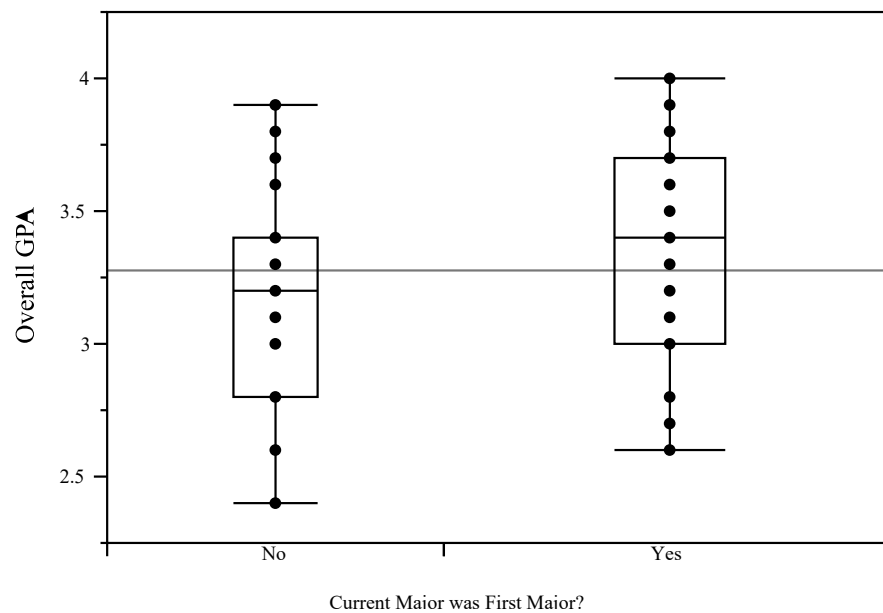


Figure 8. Overall GPA by Current Major as First Major Box Plot

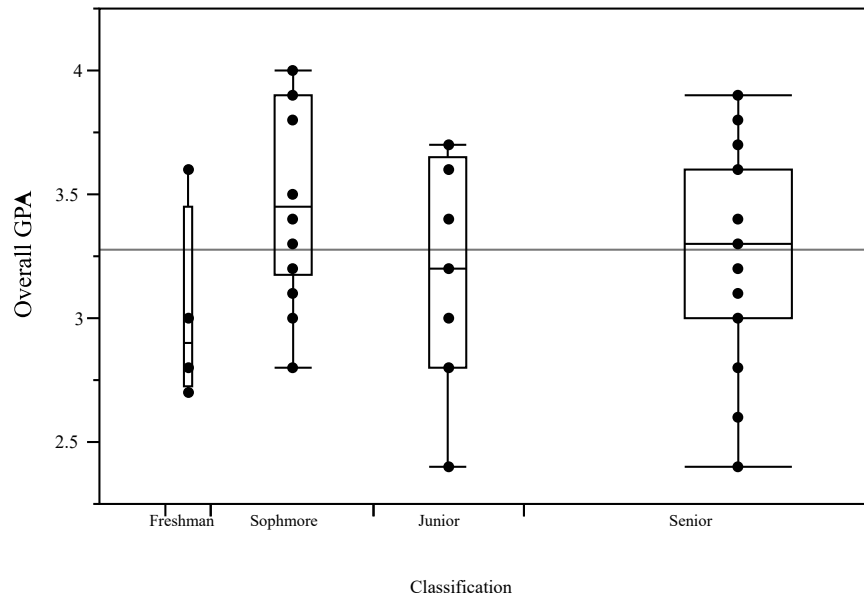


Figure 9. Overall GPA by Classification Box Plot

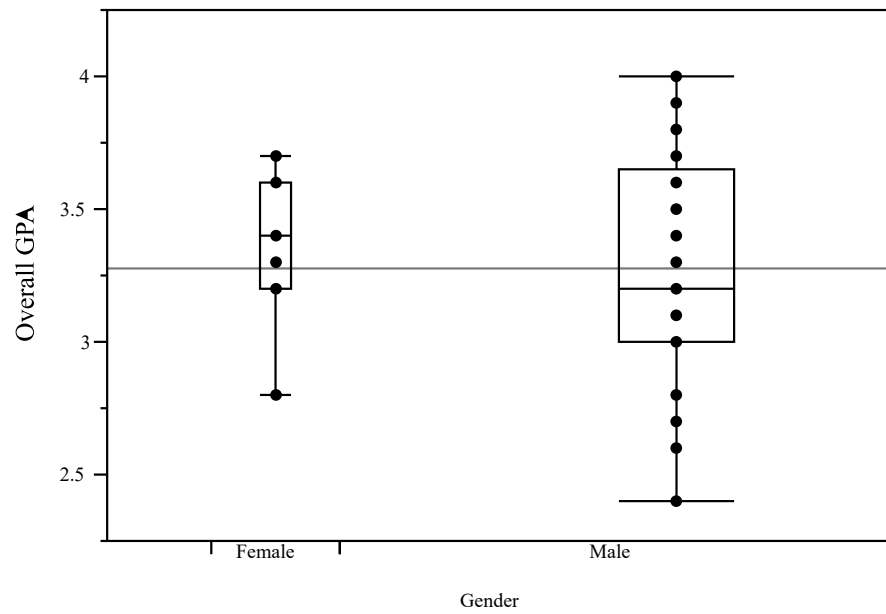


Figure 10. Overall GPA by Gender Box Plot

Table 8. Analysis of Variance of Overall GPA by Demographics and Understanding and Use of Strengths

Source	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P Value
Model	27	4.875047	0.180557	0.9698	.5253
Error	40	7.447306	0.186183		
Corrected Total	67	12.322353			

## Discussion

### Student use of strengths in academics

A major focus of this research was to determine how students were using their strengths in their academic life. The survey and interviews resulted in complementary information from participants on how the strengths were being used in academics. From the survey, academic tasks where students worked with others were frequently noted when participants were asked where they used their strengths. In the interview, most participants did not generally describe strengths as being useful academically on an individual basis. While only three of the participants described strengths as being useful academically nearly all participants described a situation where they used their strengths when working with others.

Further, a common pattern between the survey data and information gathered from the interview was that even though students may not have perceived strengths as being useful in academics, they were using their strengths when working on group projects or working with others. Interview responses of students describing communication of abilities when working in teams was evidence of this. Further, in the survey data, where participants were asked to describe a situation where they used their strengths three of the four most frequently identified themes were related to working in groups. Knowing where to contribute, delegating tasks or managing, and knowing how to work together, are all survey response themes of working with others.

When considering individual work, the survey data showed that the least frequent categories of where participants identified as situations where they used their strengths were focused on individual work. More specifically, likely the most individual academic task, tests and exams, was the least frequently selected academic task where participants identified using their strengths. Though the CSF model is frequently used in the context of teams, it is also intended to be used on an individual basis. Further, the themes from the survey question asking participants to describe how they use their strengths had one theme that relates to individual work: the student's confidence in his/her work. Of the four main themes derived from the survey question, how students perceived the use of strengths in individual work, it was the only one that focused on individual use of strengths. The other main themes that emerged from the analysis were frequently related to working with others. When interview participants were asked to describe a specific situation where they used their strengths only two of the participants described situations that related to individual work such as planning for homework or adapting to new situations.

Commonly, participants described and emphasized the use of their strengths when working with others. Though participants do mention some use of strengths individually in the interview and the survey, participants identify the majority of the use of their strengths when they are working on a team or group. This result is likely most prevalent because when students work in teams, they often divide up the work based on individual student expertise, which results from students actively identifying what they are good at. Though students likely use their strengths individually as well, students perceive teamwork to be the dominant area where they use them. To answer the question of how each student uses strengths in his/her/their academic experiences, it seems in this case, strengths are applied in a team or group setting. Overall,

although the interview responses suggest that students use their strengths individually, the results of this research suggest the students primarily identify the use of strengths when working with others.

### **Student perceptions of strengths and academic success**

Another major goal of this research was to identify if there was an influence on academic success due to the level of student use and understanding of strengths. To assist in the variation of what students perceive as academic success, the survey and the interview allowed the participants to use their own definition of success. That is, the survey did not define success for them nor were they provided a definition of success in the interview, they were allowed to use their own definition of success. In the survey, participants were asked to rank how strengths helped them to be successful in their academic pursuits, their careers and personal life. The results from this question in the survey showed that students perceived that strengths were most helpful in their career success, then in their personal life success, and lastly in their academic success. However, the statistical analysis showed no significant difference between these groups meaning there is no difference in how participants perceive the influence of strengths on their success in the three categories. Yet, students surveyed did perceive strengths as helpful to their success overall, as evidenced by an average rating of approximately seven on a scale of ten. The lack of significant difference in these groups is a finding that aligns with the CSF model in that strengths are used throughout everything that individuals do, that is, how they think, feel and behave, not just in one aspect such as their career or personal life.

In the interview, participants were asked to describe a successful student. None of the participants described a high GPA as indicator of a successful student. Success among the interview participants was generally defined by learning and application of that learning in the

future. Participants described what educators attempt to do, measure learning, but they do not perceive GPA is a good measure of learning. On the discussion of teams, when participants were asked to describe a successful team, there was again no mention of high grades or a high GPA. Instead, participants described successful teams as those that can work together and get things done. Though interview participants made no mention of strengths when discussing successful teams, participants did describe the importance of knowing what they and others are good at, suggesting that strengths plays at least some role in team success. This is supportive of the earlier finding where strengths were found more useful to team and groupwork than to individual work.

Earlier evidence described how students perceive strengths to be most useful in teamwork. However, when interview participants were asked if there were a certain set of strengths that would make a student more successful than others, all participants had a clear response. All interview participants felt that some strengths had more influence on success than others. This suggests that students recognize the role strengths play in individual academic success, even when they were not able to clearly see the concept in their own learning.

The answer to the question of what influence student understanding and use of strengths have on academic success is dependent on whether students were working as an individual or with a team. In an individual setting, students identified specific strengths predictive of successful students. On teams, students do not perceive a specific set of individual strengths as connected to success, rather, they see that a simple awareness of strengths was connected to success. In the context of teams, they describe how individuals will be good at some things and as long as they can identify what tasks each individual on the team is good at, they can be a successful team. While on an individual level, students perceive that they should have some specific set of strengths to be successful. This suggests a contradictory thinking approach where participants

perceive specific strengths as irrelevant to the success of teams, while they perceived a set of specific strengths as important to individual success.

### **Use and understanding of strengths and GPA**

To explore the relationship between strengths and GPA, part of the survey asked participants to rank their usage and understanding of strengths. Participants were then asked to report their overall and core GPA. Regardless of the type of statistical model used or the demographic factors included, there was no significant relationship between the understanding and use of strengths and student GPA, core or overall. The lack of significant relationship between strengths and GPA is a positive finding in that the instruction in the department is not catering to a specific set of strengths that students may have. Rather, students are able to earn their grade without regard to the set of strengths they may have.

Results reported earlier show how participants in the interview indicated it is not important to know your strengths but is important to know what you are good at. This suggests that students perceive that you should know what you are good at, but you don't need a name for these strengths (such as those in the Clifton StrengthsFinder) to be successful. The statistical models used to investigate the connection between use and understanding of strengths confirm student perceptions on the value of the strengths in that use and understanding of strengths is not significant. However, the CSF is a valid and reliable (Schreiner, 2006) assessment to identify what a person is good at in the context of well-defined abilities that are readily communicated to others. On the other hand, students self-assessing their strengths is not as valid or as reliable. A better understanding of "what students are good at" helps faculty work more effectively with students to encourage enhanced critical thinking, problem solving, and communication skills.

We know students communicate about abilities when working on teams, but we also know they are not using CSF strengths as part of this communication. We also know students do not perceive strengths as useful on an individual basis. With these two main understandings, we better know where to focus instructional efforts when teaching students about strengths and how to use them in the classroom and on the job. When students are learning about strengths, there should be more focus on how they can use them on an individual basis. Further when students learn about strengths, there should be more focus on how they can be used to communicate with others clearly and concisely about what they are good at to build the strongest team. Rath and Conchie (2008) and others report that diverse teams make better decisions and reach greater outcomes than teams that think and are alike. A better understanding of student strengths allow faculty to push each student to add their own value to teams they work on, whether in the classroom, on the job, or in their personal relationships.

### **Conclusions and Limitations**

Overall, this research has shown that students do use the understanding of their strengths in their academic endeavors and perceive that strengths have some importance in their success, particularly as related to teamwork. The importance of understanding and using the strengths has been shown to be unrelated to student GPA. The majority of students perceive that strengths are most useful when working with others to build successful teams. This perception aligns with Allen et al. (2013); Rath and Conchie (2008); Shimazoe, Aldrich 2010, who describe how successful teams should be diverse in strengths. Further, although students perceive that there are specific strengths that makes some students more successful than others, this research did not identify these strengths specifically. This was a positive finding because it suggests that department faculty are not catering teaching techniques toward one leadership domain or one type of strength profile. Further, the strengths students believed were most predictive of success



were not specified by the students. This is one important area of future research: an investigation of the relationship between specific strengths and GPA to empirically establish this perception.

The research was limited by several factors. This work took place with students from four majors in one department on one university campus. The findings in this study are not generalizable to other departments, even those departments with similar characteristics. Although the number of survey respondents was adequate, a greater response would have provided a more complete picture of the sample under investigation. During the survey, participants were asked to provide their own GPA which could have resulted in reported GPA values that were not correct. Further, this research is focused on a small window of students over the previous three years. Students and their perceptions can change and thus, the results of this research could change in the future.

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## **CHAPTER 5. GENERAL CONCLUSIONS AND RECCOMENDATIONS FOR FUTURE RESEARCH**

### **Conclusions**

The overall objective of this research was to explore the ability of the Clifton StrengthsFinder (CSF) tool to better understand the strengths of departmental students and to explore how student perceptions and understanding of their strengths influences their educational experiences and outcomes. This objective was divided into three individual research objectives as documented in chapters two, three, and four.

The objective of chapter two was to characterize the departmental students by CSF strengths. Students in the department have been completing the CSF for multiple years and thus far, there has been no characterization of the student strengths. The analysis in this chapter was able to successfully characterize the students by their CSF strengths and identify patterns among groups. There were patterns of strengths evident among students based on major and gender. The most frequent strengths among departmental students were Achiever, Restorative, Adaptability, Analytical, and Relator. These strengths reflect the problem-solving and analysis typical of an engineering and technology department as well as the tight-knit social networks common in small disciplines such as agricultural engineering. Yet, nearly 80% of students possessed two or fewer of the most frequent strengths in the department, providing a challenging environment for teaching and learning. To address the wide variety of students in their classrooms, faculty should remain open-minded and tolerant of diverse approaches to problem-solving, learning, and success. When working with students on an individual basis or in small course groups, faculty should remember that learning occurs differently for each student. This research suggests that at least some of those differences in how students learn may be related to their individual strength profiles.

The primary objective for chapter three was to identify the leadership domains of the students in the department and explore the ability to characterize groups of students in the department by their leadership domains. The analysis in this chapter was able to identify patterns of leadership domains and dominant leadership domains of students in the department. Further, the analysis allowed a comparison of departmental patterns with peers at other institutions and among other people in the general population of the United States. Though there were no differences in leadership domains of departmental students at the departmental level and major level, gender differences were identified. Female students in the department had different leadership domains than did males within and across the majors in the department, suggesting that females who find success in the male dominated department use a difference approach in their path to leadership. The male students in this study overwhelmingly showed Executing as their most frequent dominant leadership domain, suggesting that both engineering and technology male students' power through their rigorous coursework by staying focused on "getting things done". Females, on the other hand, seem to use a more strategic planning or relationship-based approach. Perhaps the ability to successfully manage time, relationships, and other resources in a department where all female students are underrepresented is a critical factor in the success. What remains unknown is whether this same pattern is true of other male-dominated engineering and technology departments.

Further, identification of patterns of leadership domains in the department indicated that the lowest level of dominant leadership domain was Influencing, which emphasizes communication and leadership. Neither of these so-called "soft skills" are emphasized in STEM disciplines, including the programs within the department studied. The finding also suggests that students with a dominant domain in Influencing could feel a bit out of sorts in the department.

This finding suggests that students with a dominant leadership domain in Influencing can potentially bring a different skill set to courses and teamwork. One way to manage a student with a dominant domain in Influencing is to be very purposeful in how the student is placed on a team. A second way to manage is be cognizant of the possibility that Influencing students likely already aware that they approach problems differently than most of the other students they interact with. Faculty can encourage other students to value the skills brought to the course or team by a person who is dominant in Influencing. Influencing dominant students should be placed in teams with purpose as they provide a different view on how to lead, approach problems, and accomplish tasks.

The third chapter's primary objective was to establish student perceptions of CSF strengths and the connection between use and understanding of strengths and student GPA. The analysis of this chapter was split into quantitative data and qualitative data. The quantitative data were used to explore the relationship of each student's use and understanding of strengths with GPA. The qualitative data were used to identify themes of student perceptions surrounding the use and understanding of the CSF strengths. The analysis of this research identified that students do use their understanding of CSF strengths in academic tasks and they perceive that CSF strengths have some connection to their success.

The majority of students in this research identified strengths as being most useful when working in groups or teams. Students also perceived that there are a certain set of strengths that make some students more successful than others. The quantitative aspect of this research identified no significant relationship between use and understanding of strengths with GPA. The specific strengths that students perceive as being connected to success are currently unknown.

Overall, the results of the research from the three chapters have developed an understanding of CSF strengths in the department. A foundation of information on student strengths and leadership domains that currently describe departmental students has been built. Further, a basis of student use and understanding of strengths in the department has been set. These results provide an understanding that can be used to better provide for the student educational needs in terms of advising current and prospective students on curricular options and professional development. Further, these results provide insight into how educators can approach evaluation of students.

### **Limitations**

Limitations, as mentioned in the previous chapters are inherent to research. One of the main limitations of this research that applies to all three research projects in this dissertation is the population of students involved. This data set was limited to students from one department, taken over three years, from one course. Student strengths can differ from semester to semester or from class to class, therefore, the information from the three years of data cannot be generalized to other years. The characterization research in chapters two and three of this research used student data that was a snapshot from three previous years of classes. This data could change, and the characterization profile of students could change over time. Further, along with students' strengths profiles changing over time, student perceptions and utilization of strengths may also change.

This research was examining strengths at the macro level, that is, the focus is on the department and the majors. While this provides a broad overview of the department and majors, it does not necessarily relate to micro level scenarios such as class projects and individual students. This research points out that there are patterns among the departmental students, but it also identifies that these results cannot be generalized to individuals or small groups.

Another limitation of this research is that it took place with four majors in one department from one university. The results of this research are not likely generalizable to other departments across the nation, even those that resemble this department. As mentioned previously, student strengths can change from class to class or from semester to semester meaning they would likely change from institution to institution.

In chapter four of this research, perceptions and data were analyzed from a small data set. Though the sample size for this research was adequate, it is possible that a larger sample size would provide an alternate set of results by providing a more complete picture of the department. Further, from chapter four, much of the data came from student provided information. Student perceptions can change from day to day and student error on the survey for GPA or ratings of strengths could alter the overall picture of student perceptions and utilization of strengths.

### **Recommendations for future research**

One of the limitations of this research was that student strengths and leadership domain profiles could change over time. Yet, the understanding of one's strengths and how to build on them to enhance individual success is a skill learned over a lifetime. Most college students begin their careers hoping for success, but many are unsure where that hope leads them or what it means. Strengths have the potential to help students identify not only what they want to do, but a pathway to a purpose-driven, happy career. Future research that continuously monitors the strength and leadership domain profiles of the students in the department could help identify if these results are consistent over time. Consistent strength profiles over time would make a stronger argument for any needed modification to curriculum and advising methods.

Another recommendation of future research is based on the limitation that this research characterized a large group of students at the departmental level. Future research should focus on smaller groups of students on a per class basis to identify the repeatability of the characterization.



This research would provide a much stronger result that could inform the curriculum for specific courses or projects. Within the topic of curriculum projects, future research should focus on the development of teams based on strengths and leadership domains. Investigation of strengths-based teams could provide insight into project and curriculum development specific to the engineering and technology fields of study in the department.

Because this research was focused on a single department at one university, future research should examine similar departments across the nation. Though it would seem these results are not generalizable to other similar departments, there has been other research that provides evidence of strengths patterns across universities, within a type of degree program. This research would further help to mitigate the limitation of small sample size by acquiring participation across multiple institutions. A better understanding of the strength profiles and leadership domains has the potential to change the conversations faculty, parents, and advisers have with prospective college students. More data would assist in this understanding. Yet, individually, each person can optimize his/her/their future today by understanding the strength profile, determining the best approach for leadership, and using that information to improve relationships with colleagues, supervisors, and family members.

**APPENDIX A. INTERVIEW PROTOCOL**

Time of Interview:

Date:

Place:

Method of Interview: Face-to-face

Interviewer:

Thank you for taking the time to meet with me today. I will be performing an interview on Clifton StrengthsFinder and how you apply them. The data I am gathering will be analyzed and reported in my PhD dissertation. All responses will be classified as confidential and all participants will be recorded as anonymous.

I will be asking you a series of questions and recording your responses to correctly capture your answers. Do I have your permission to record the interview?

Yes \_\_\_\_ No \_\_\_\_

There are no right or wrong answers, and it is okay to say “I do not know”, or “I am not sure”. Your participation is completely voluntary. You may end the interview at any time.

If you prefer not to answer a question, please let me know and I will skip the question.

Do you have any questions before we begin?

## **Form of Consent for Participants**

Today, I, Saxon J. Ryan, will be conducting an interview as part of data collection for my PhD research. The interview is designed to take about 30 minutes to complete. There are no right or wrong answers. You may end the interview at any time and ask me to skip any question that you prefer not to answer. Your name will not be identified in the report. I will ask for your consent to audiotape the interview. Electronic and hard copies of interviewer notes and other related data will be stored in secured locations.

The purpose of this study is to determine how ABE students use their strengths to successfully complete coursework within their degree program. If you agree to participate, you will be asked demographic questions as well as questions about your Clifton StrengthsFinder results and how you use them in your coursework. Research studies include only people who choose to take part; therefore, your participation is completely voluntary, and you may withdraw your participation at any time.

There are no foreseeable risks or discomforts associated with participating in this research. There will be no record of participant identity. Each participant will be assigned a number that will not be aligned with participant identification.

You are eligible to participate in this study if you are a student in the Agricultural and Biosystems Engineering Department, have completed ABE or TSM 201, and are 18 or older.

You should not participate if you are not currently a student in the Agricultural and Biosystems Engineering Department, if you have not completed ABE or TSM 201, or you are under the age of 18.

This study is being conducted by Saxon Ryan under the supervision of Dr. Gretchen Mosher. Questions about this study can be directed to Saxon Ryan ([saxon@iastate.edu](mailto:saxon@iastate.edu)) or Dr. Gretchen Mosher ([gamosher@iastate.edu](mailto:gamosher@iastate.edu))

We thank you for your time and effort.

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, [IRB@iastate.edu](mailto:IRB@iastate.edu), or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

**For the interview participant:**

I am aware that my participation in this interview is voluntary. I understand the intent and purpose of this interview. If for any reason I wish to stop the interview, I may do so without having to give an explanation. I have the right to decline having the interview recorded.

I am free to contact the interviewer, Saxon Ryan by email at [saxon@iastaet.edu](mailto:saxon@iastaet.edu) if I have any questions about the interview. I have read the above form and understand that I can withdraw at any time and for whatever reason. I consent to participate in today's interview.

By signing this document, you are agreeing to participate in this study. Make sure you understand what the study involves before you sign. If you have any questions about the study after you agree to participate, you can contact the research team using the information provided above.

I am 18 years of age or older and agree to take part in this study.

Participant's Name (printed) \_\_\_\_\_

\_\_\_\_\_

Participant's Signature

\_\_\_\_\_

Date

\_\_\_\_\_

Signature of Interviewer

\_\_\_\_\_

Date

**General**

1. What is your Major?
2. Is your current major the first major you have had at ISU? If not, what was your original major?
3. Are you a freshman, sophomore, junior, or senior?
4. What is your gender?
5. How would you describe your grades and success in your degree?
  - Do you think you are a high, above average, average, below average, low?
  - Overall and Core GPA
  - Are there any courses you have done particularly well or not so well in?
    - i. What grades did you get in those courses?
    - ii. Why do you think you did so well or not so well?
    - iii. Were there courses you liked but did not do well? Why?
    - iv. Were there courses you disliked, but did well? Why?
6. Please describe how well you understand your Clifton StrengthsFinder results from ABE/TSM 201.
  - What are your strengths? Can you describe what they mean?
  - What are your leadership domains? Can you describe what they mean?
  - Do you have any dominant leadership domains? Can you describe what it means to have a dominant domain?
7. Do you think knowing your strengths is useful in terms of coursework? Why or why not?

**If strengths are not known skip this section:**

8. How often do you think you use your strengths?
9. Can you describe how you use your strengths?
10. Can you describe a specific situation where you used your strengths?
11. Do you think there are a set of strengths or leadership domains that make students more successful in your major or specific courses?

**Coursework**

12. How would you describe a successful student?
13. Which course was your favorite overall?
  - Which major specific course was your favorite?
  - Which major specific course was your least favorite?
14. How do you typically approach coursework?
  - Homework
  - Exams
15. Can you provide an example of a difficult task and an easy task from a course?
16. Thinking about group projects you have participated in, what went well and what did not go well?
  - Specific team members
  - Tasks involved in the project
17. How would you describe a successful team?

**Student Clubs**

Are you currently or have you in the past been involved in any student clubs?

- What was or is your role?
- Can you describe difficult situations or projects from that role?
- Can you describe situations or projects that went well?

Do you think participation in clubs helps your learning? Why or why not?

Thank the individual for participating in this interview.

Assure him/her of the confidentiality of responses.

Inform him/her that a feedback validation will be done, and he/she will receive a copy of the interview transcript to validate the information.



## **APPENDIX B. SURVEY**

*Note: The survey was modified from the online format.*

### **Student Strengths Overview**

Hello,

You are invited to participate in a web-based survey to determine how technology and engineering students in the department of Agricultural and Biosystems Engineering use strengths within their degree program.

You are eligible to participate in this study if you are a student in the Agricultural and Biosystems Engineering Department, have completed ABE or TSM 201, and are 18 or older.

You should not participate if you are not currently a student in the Agricultural and Biosystems Engineering Department, if you have not completed ABE or TSM 201, or you are under the age of 18.

If you agree to participate, you will be asked to complete the survey, including up to 6 demographic questions and up to 15 questions about your Clifton StrengthsFinder results and how you use them in your coursework. The survey should take no longer than 10 to 15 minutes. Research studies include only people who choose to take part, therefore, your participation is completely voluntary and you may withdraw your participation at any time.

There are no foreseeable risks or discomforts associated with participating in this research. There will be no record of participant identity. Each participant will be assigned a number that will not be aligned with participant identification. All presentation of data will be combined, so that no one individual's responses are singled out.

The information gained in this study aims to better understand ABE students to help them to be more successful academically. You are not expected to directly benefit from participation in the study.

This study is being conducted by Saxon Ryan under the supervision of Dr. Gretchen Mosher. Questions about this study can be directed to Saxon Ryan ([saxon@iastate.edu](mailto:saxon@iastate.edu)) or Dr. Gretchen Mosher ([gamosher@iastate.edu](mailto:gamosher@iastate.edu)).

We thank you for your time and effort.

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, [IRB@iastate.edu](mailto:IRB@iastate.edu), or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

By clicking below, you are agreeing to participate in this study. Make sure you understand what the study involves before you agree. If you have questions about the study after you agree to participate, you can contact the research team using the information provided above.

You may print a copy of this form for your files.

☐ I certify that I am 18 years of age or older and agree to participate in this research study.

☐ I do not want to take the survey

*Skip To: End of Survey If Hello, You are invited to participate in a web-based survey to determine how technology and engin... = I do not want to take the survey*

1. What is your major? If you are a double major, select your primary major.

☐ Agricultural Engineering

☐ Agricultural Systems Technology

☐ Biological Systems Engineering

☐ Industrial Technology

2. Is your current major the first major you have had at ISU?

☐ Yes

☐ No

*Display This Question: If Is your current major the first major you have had at ISU? = No*

3. You indicated that your current major was not your first major at ISU. What was your original major at ISU?

4. What is your classification?



- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

5. Please indicate your gender.

---

6. Please indicate your GPA

0                      1                      2                      3                      4

Overall	
Core courses	

7. When thinking about your Clifton StrengthsFinder results, what option below best describes you?

- ☐ I understand and apply my understanding of my strengths to be more successful
- ☐ I understand my strengths and sometimes apply my understanding of them to be more successful
- ☐ I understand my results but I do not apply my understanding of them to be more successful
- ☐ I do not understand my results
- ☐ I have never taken the Clifton StrengthsFinder Survey

*Skip To: End of Survey If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I have never taken the Clifton StrengthsFinder Survey*

*Display This Question: If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I do not understand my results*

8. When thinking about your Clifton StrengthsFinder results, did you learn about **leadership domains**?

- ☐ Yes, I apply my understanding of them to be successful
- ☐ Yes, I sometimes apply my understanding of them to be successful
- ☐ Yes, but I do not apply my understanding of them to be successful
- ☐ No

*Skip To: 19 If When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = No*




*Display This Question: If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I do not understand my results*

9. When thinking about your Clifton StrengthsFinder results, did you also learn about **leadership domains**?

- ☐ Yes, I apply my understanding of them to be successful
- ☐ Yes, I sometimes apply my understanding of them to be successful
- ☐ Yes, but I do not apply my understanding of them to be successful
- ☐ No

*Display This Question: If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I do not understand my results*

10. On a scale of 0 to 10 how helpful is knowing your strengths in being successful in the following

	Not at all helpful	Very helpful
	0 1 2 3 4 5 6 7 8 9 10	
In your career		
Academically		
In your personal life		

*Display This Question: If When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, I apply my understanding of them to be successful*




*And When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, I sometimes apply my understanding of them to be successful*

*Or When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, I apply my understanding of them to be successful*

*Or When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, I sometimes apply my understanding of them to be successful*

11. On a scale of 0 to 10 how helpful is knowing your **leadership domains** to be successful in the following

0 1 2 3 4 5 6 7 8 9 10

In your career	
Academically	
In your personal life	

*Display This Question: If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I understand and apply my understanding of my strengths to be more successful*

*Or When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I understand my strengths and sometimes apply my understanding of them to be more successful*

12. Academically, where do you use the knowledge of your strengths. Select all that apply.

- ☐ Projects
  - ☐ Homework
  - ☐ Tests/Exams
  - ☐ Group Related Activities/Projects
  - ☐ Labs
  - ☐ Other, please describe:
- 

*Display This Question: If When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, I apply my understanding of them to be successful*

*And When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, I sometimes apply my understanding of them to be successful*

*And When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, I apply my understanding of them to be successful*

*And When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, I sometimes apply my understanding of them to be successful*

13. Academically, where do you use the knowledge of your **leadership domains**. Select all that apply.

- ☐ Projects
- ☐ Homework
- ☐ Tests/Exams
- ☐ Group Related Activities/Projects
- ☐ Labs
- ☐ Other, please describe: \_\_\_\_\_

*Display This Question: If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I understand and apply my understanding of my strengths to be more successful*

*Or When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I understand my strengths and sometimes apply my understanding of them to be more successful*

14. Briefly describe how you apply strengths in an academic environment you selected above. (Projects, Homework, Exams, Projects, Labs and others)

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*Display This Question: If When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, I apply my understanding of them to be successful*

*Or When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, I sometimes apply my understanding of them to be successful*

*Or When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, I apply my understanding of them to be successful*

*Or When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, I sometimes apply my understanding of them to be successful*

15. Briefly describe how you apply **leadership domains** in an academic environment you selected above. (Projects, Homework, Exams, Projects, Labs and others)

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*Display This Question: If When thinking about your Clifton StrengthsFinder results, what option below best describes you? = I understand my results but I do not apply my understanding of them to be more successful*

16. You indicated that you understand your strengths but you do not apply that understanding to be successful. Please briefly describe why you choose not to apply the knowledge of your strengths.

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*Display This Question: If When thinking about your Clifton StrengthsFinder results, did you learn about leadership domains? = Yes, but I do not apply my understanding of them to be successful*

*Or When thinking about your Clifton StrengthsFinder results, did you also learn about leadership dom... = Yes, but I do not apply my understanding of them to be successful*

17. You indicated that you understand your **leadership domains** but you do not apply that understanding to be successful. Please briefly describe why you choose not to apply the knowledge of your **leadership domains**.

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18. When working in groups or teams indicate on a scale from 0 to 10 how helpful it is to have a diverse set of strengths

Not at all helpful                      Very helpful

0   1   2   3   4   5   6   7   8   9   10

	
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19. Have you worked with others that know and use the understanding of their strengths?

☐ Yes

☐ No

20. Have you worked with others that know and use the understanding of their **leadership domains?**

☐ Yes

☐ No

*Display This Question: If Have you worked with others that know and use the understanding of their strengths? = Yes*

21. On a scale of 0 to 10 how helpful is it to work with someone else that knows their strengths?

Not at all helpful

Very helpful

0 1 2 3 4 5 6 7 8 9 10

	
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*Display This Question: If Have you worked with others that know and use the understanding of their leadership domains? = Yes*

22 On a scale of 0 to 10 how helpful is it to work with someone else that knows their **leadership domains?**

Not at all helpful

Very helpful

0 1 2 3 4 5 6 7 8 9 10

	
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*We thank you for your time spent taking this survey.*

*Your response has been recorded.*

**Exemption Date:** 11/30/2018

**Detailed information about requirements for submission of modifications can be found on our [website](#).** For modifications that require prior approval, an amendment to the most recent IRB

application must be submitted in IRBManager. A determination of exemption or approval from the IRB must be granted before implementing the proposed changes.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Please note that you must submit all research involving human participants for review. **Only the IRB or its designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed**. For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please be advised that your research study may be subject to post-approval monitoring by **Iowa State University's Office for Responsible Research**. In some cases, it may also be subject to formal audit or inspection by federal agencies and study sponsors.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or [IRB@iastate.edu](mailto:IRB@iastate.edu).

## APPENDIX D. CLIFTONSTRENGTHS THEMES

This listing of strengths themes and brief definitions are a quote from:

Gallup (2018). *Cliftonstrengths quick reference card*. Gallup.

<https://www.gallup.com/workplace/245090/cliftonstrengths-themes-quick-reference-card.aspx>

1. Achiever: People exceptionally talented in the Achiever theme work hard and possess a great deal of stamina. They take immense satisfaction in being busy and productive.
2. Activator: People exceptionally talented in the Activator theme can make things happen by turning thoughts into action. They are often impatient.
3. Adaptability: People exceptionally talented in the Adaptability theme prefer to go with the flow. They tend to be “now” people who take things as they come and discover the future one day at a time.
4. Analytical: People exceptionally talented in the Analytical theme search for reasons and causes. They have the ability to think about all the factors that might affect a situation.
5. Arranger: People exceptionally talented in the Arranger theme can organize, but they also have a flexibility that complements this ability. They like to determine how all of the pieces and resources can be arranged for maximum productivity.
6. Belief: People exceptionally talented in the Belief theme have certain core values that are unchanging. Out of these values emerges a defined purpose for their lives.
7. Command: People exceptionally talented in the Command theme have presence. They can take control of a situation and make decisions.

8. Communication: People exceptionally talented in the Communication theme generally find it easy to put their thoughts into words. They are good conversationalists and presenters.
9. Competition: People exceptionally talented in the Competition theme measure their progress against the performance of others. They strive to win first place and revel in contests.
10. Connectedness: People exceptionally talented in the Connectedness theme have faith in the links among all things. They believe there are few coincidences and that almost every event has meaning.
11. Consistency: People exceptionally talented in the Consistency theme are keenly aware of the need to treat people the same. They try to treat everyone with equality by setting up clear rules and adhering to them.
12. Context: People exceptionally talented in the Context theme enjoy thinking about the past. They understand the present by researching its history.
13. Deliberative: People exceptionally talented in the Deliberative theme are best described by the serious care they take in making decisions or choices. They anticipate obstacles.
14. Developer: People exceptionally talented in the Developer theme recognize and cultivate the potential in others. They spot the signs of each small improvement and derive satisfaction from evidence of progress.
15. Discipline: People exceptionally talented in the Discipline theme enjoy routine and structure. Their world is best described by the order they create.
16. Empathy: People exceptionally talented in the Empathy theme can sense other people's feelings by imagining themselves in others' lives or situations.

17. Focus: People exceptionally talented in the Focus theme can take a direction, follow through, and make the corrections necessary to stay on track. They prioritize, then act.
18. Futuristic: People exceptionally talented in the Futuristic theme are inspired by the future and what could be. They energize others with their visions of the future.
19. Harmony: People exceptionally talented in the Harmony theme look for consensus. They don't enjoy conflict; rather, they seek areas of agreement.
20. Ideation: People exceptionally talented in the Ideation theme are fascinated by ideas. They are able to find connections between seemingly disparate phenomena.
21. Includer: People exceptionally talented in the Includer theme accept others. They show awareness of those who feel left out and make an effort to include them.
22. Individualization: People exceptionally talented in the Individualization theme are intrigued with the unique qualities of each person. They have a gift for figuring out how different people can work together productively.
23. Input: People exceptionally talented in the Input theme have a craving to know more. Often they like to collect and archive all kinds of information.
24. Intellection: People exceptionally talented in the Intellection theme are characterized by their intellectual activity. They are introspective and appreciate intellectual discussions.
25. Learner: People exceptionally talented in the Learner theme have a great desire to learn and want to continuously improve. The process of learning, rather than the outcome, excites them.
26. Maximizer: People exceptionally talented in the Maximizer theme focus on strengths as a way to stimulate personal and group excellence. They seek to transform something strong into something superb.

27. Positivity: People especially talented in the Positivity theme have contagious enthusiasm. They are upbeat and can get others excited about what they are going to do.
28. Relator: People exceptionally talented in the Relator theme enjoy close relationships with others. They find deep satisfaction in working hard with friends to achieve a goal.
29. Responsibility: People exceptionally talented in the Responsibility theme take psychological ownership of what they say they will do. They are committed to stable values such as honesty and loyalty.
30. Restorative: People exceptionally talented in the Restorative theme are adept at dealing with problems. They are good at figuring out what is wrong and resolving it.
31. Self-Assurance: People exceptionally talented in the Self-Assurance theme feel confident in their ability to manage their own lives. They possess an inner compass that gives them confidence that their decisions are right.
32. Significance: People exceptionally talented in the Significance theme want to be very important in others' eyes. They are independent and want to be recognized.
33. Strategic: People exceptionally talented in the Strategic theme create alternative ways to proceed. Faced with any given scenario, they can quickly spot the relevant patterns and issues.
34. Woo: People exceptionally talented in the Woo theme love the challenge of meeting new people and winning them over. They derive satisfaction from breaking the ice and making a connection with someone.



## APPENDIX E. LEADERSHIP DOMAINS

The following leadership domain arrangement of CliftonStrengths themes and descriptions are quoted from:

Gallup (n.d.). *What Are the Four Domains of CliftonStrengths?*. Gallup.

<https://www.gallup.com/cliftonstrengths/en/253736/cliftonstrengths-domains.aspx#ite-253169>

<b>Executing</b>	<b>Influencing</b>	<b>Relationship Building</b>	<b>Strategic Thinking</b>
<p>These themes answer the question "How do you make things happen?" They may help you turn ideas into reality.</p> <p>When teams need to implement a solution, they look to people with Executing themes who will work tirelessly to accomplish the goal.</p>	<p>These themes answer the question "How do you influence others?" They may help you take charge, speak up and make sure others are heard.</p> <p>When teams need to sell their ideas inside and outside the organization, they turn to people with Influencing themes to convince others.</p>	<p>These themes answer the question "How do you build and nurture strong relationships?" They may help you hold a team together.</p> <p>When teams need to be greater than the sum of their parts, they turn to people with Relationship Building themes to strengthen their bonds.</p>	<p>These themes answer the question "How do you absorb, think about and analyze information and situations?" They may help you make better decisions and create better outcomes.</p> <p>When teams need to focus on what could be, they turn to people with Strategic Thinking themes to stretch the team's thinking for the future.</p>
Achiever Arranger Belief Consistency Deliberative Discipline Focus Responsibility Restorative	Activator Command Communication Competition Maximizer Self-Assurance Significance Woo	Adaptability Developer Connectedness Empathy Harmony Includer Individualization Positivity Relator	Analytical Context Futuristic Ideation Input Intellection Learner Strategic